OFFICIAL PUBLICATION OF THE PROCEEDINGS AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS

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VOLUME 40, No. 2

AMERICAN DYESTUFF REPORTER

DEVOTED TO TEXTILE CHEMISTRY • BLEACHING • DYEING • PRINTING • FINISHING

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Colors *custom-made* for nylon

NEW DU PONT NEUTRACYL DYES
are neutral dyeing colors—
designed specifically to produce the *highest possible light fastness on nylon.*

They can be applied in the same short time cycle as acid colors . . . but have decidedly superior light and wet fastness on filament nylon. For example, Neutracyl Blue G is especially recommended for dyeing nylon staple. The dyed staple can be converted into those fabrics which require superior light fastness—such as upholstery materials, automotive top materials, government fabrics and outerwear.

These NEUTRACYL dyes are suitable for dyeing wool, giving fastness properties similar to nylon.

For information on NEUTRACYL dyes . . . or for help on any coloring problem . . . consult our Technical Staff. E. I. du Pont de Nemours & Co. (Inc.), Dyestuffs Division, Wilmington 98, Delaware.

Du Pont Dyestuffs

DU PONT

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

for Sanforized Fabrics

✓ Superior Fiber Lubrication
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ONE Emery Twitchell Oil Gives You All Three!

In each of these improved Twitchell Oils, you will find all the qualities necessary for the efficient production of Sanforized fabrics.

FIBER LUBRICATION—The excellent lubrication characteristics provide for easy and uniform rearrangement of the fibers during the preshrinking of fabrics. Prevent sticking at the shoes and enable increased processing speeds and efficiency.

REWETTING—High rewetting speeds enable faster processing and provide uniform rewetting of fabrics. Treated fabrics retain rewetting properties indefinitely.

SOFTNESS—For various fabrics and finishes, Twitchell Oils provide the different degrees of softness required to meet specific needs.

Especially compounded to keep staining at the lowest possible level, Twitchell Oils are stable, resist oxidation, yellowing, and rancidity. They are non-gumming, compatible with all common finishing agents and form stable emulsions.

Choose the Twitchell Oil which best meets your requirements—

PRODUCT	FIBER LUBRICATION	REWETTING	SOFTNESS	STAINING
Twitchell 7250	Very Good	Fastest	Softest	None
Twitchell 7240	Excellent	Fast	Moderate	None
Twitchell 7231	Excellent	Medium	Slight	None

For a recommendation to fit your particular need, contact our Sales Service Department.

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187 Perry St., Lowell, Mass.
401 N. Broad St., Philadelphia 8, Pa.
Warehouse stocks also in St. Louis, Buffalo and Baltimore

American Dyestuff Reporter, Vol. 40, No. 2, January 22, 1951. Published every other Monday. Copyright 1951, by Howes Publishing Co., Inc., 44 E. 23rd St., New York 10, N. Y. Domestic subscriptions, $5.00; Canadian, $6.00; Foreign, $10.00. Entered as second-class matter, Nov. 6, 1919, at the New York, N. Y. Post Office, under the act of March 3, 1879.

helping you
make
COLOR
behave

One sure step towards consistent color satisfaction in dyeing and printing is to investigate the A.A.P. textile auxiliaries listed below. Technicians from our nearest branch will be happy to show how each has helped leading dyers, finishers and printers... *how each can help you.*

★ **LEVELENE** For wetting-out...preparing... dyeing...finishing. Dependable as a vat dyeing retardant and as a vat stripper.

★ **FASTOGENE** Gives amazing water-fastness in a simple after-treatment. For dyeing—printing—finishing of cottons, multifibres.

★ **STABILON** A *must* with Napthols. *Minimizes* crocking and brightens Napthol shades.

★ **DEPUMA** An *antifoaming* agent for printing—dyeing—soaping. Breaks foam in dye liquors and print pastes *without emulsifying or evaporating.*

For full information on these and other A.A.P. products, along with data pertinent to your individual problems, consult our nearest branch.

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*Reg. U. S. Pat. Off.

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3 NEW NEOLANS

These newest additions to the Ciba Neolan Family have been developed to brighten the range of greens and yellows heretofore available.

In the Neolan-best-for-wool tradition, these new colors dye fast and level, are simple to apply, and are easy to shade.

Also, these Neolan greens are exceptionally stable to prolonged boiling.

Data on dyeing procedures, dyed samples and complete tables of properties are now ready.

Neolan Green BF

Neolan Flavine GFE

Neolan Green 8G

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Whether for fashion or industry, your yarns or fabrics will win greater favor, give greater service . . . and cost you less when they're processed with Laurel soaps, oils, finishes. Scientifically developed, laboratory-and mill-tested, these quality Laurel wet processing agents are pure, uniform, dependable. Only top grade raw materials are used. Since 1909, important wet processors have found Laurel processing agents yield smoother, more efficient production, more salable finished products.

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TINOPAL BVA
was made for the
Cotton and Rayon Mill

There is only one best optical bleach for cottons and viscose rayons . . . Tinopal BVA*—the fluorescent whitening agent developed specifically for mill application.

Tinopal BVA imparts to the fabric an indiscernible fluorescence that is translated by intense light reflection into brighter whites on cotton, purer whites and clearer ground shades on viscose rayons. And its affinity for cellulosic fibres makes it extremely fast to washing.

With Tinopal BVA you give your customers white goods that strike the highest note in sales appeal. Moreover, that a very high percentage of Cotton and Rayon mills is using Tinopal BVA constantly bespeaks its working properties in the mills.

If you haven't used Tinopal BVA before, write now for booklet containing complete information.

* *Reg. U. S. Pat. Off.*

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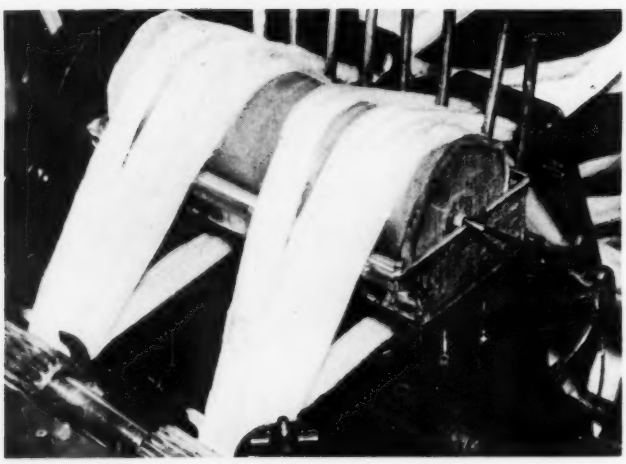
the ¢ FEW extra ¢ents that make a LOT of sense

When it comes to producing worsted yarn, there is always this important question: Should a spinner spend a few more cents than absolutely necessary when processing top, to try and achieve more efficient production and better finished products? In the case of Nopco* 1656-R, the answer is "yes".

Today, the price of top is the highest in history. Thus the few additional cents involved in the purchase of Nopco 1656-R become insignificant in the face of over-all costs. Moreover, the unique advantages afforded by this remarkable oil far outweigh its price differential when compared to alternatives. Just consider:

NOPCO* 1656-R . . .



*Reg. U. S. Pat. Off.

1. ***provides excellent lubrication and eliminates static in worsted sliver. Result: no fly from top treated with this oil—fewer ends down in spinning and winding—much less brush waste;***
2. ***increases the drag, and thereby gives a better draft—resulting in more even and cleaner yarn;***
3. ***scours out with phenomenal ease—actually converting into suds when used with alkali, polyphosphate and water;***
4. ***applies equally to all production systems—American, Bradford or French—and is extremely advantageous on pin drafters.***

Yes, it will profit you to use Nopco 1656-R wherever you employ a lubricant in your top-processing procedure. And it will profit you to specify Nopco 1656-R, as a number of spinners already do, whenever you purchase oil-combed top. You'll pay a few more cents above "rock bottom" perhaps, but when you examine your finished yarns, you'll know you have produced high quality products with surprising economy.

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Send for your FREE copy of this bulletin giving detailed information about Nopco* 1656-R

ARMOUR *Chemical Division*

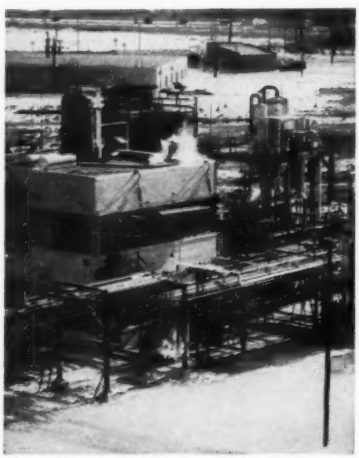
Fatty Acids
Long-Chain Fatty Acid Derivatives
Industrial Oils

Low-Temperature Solvent Crystallized Oleic Acid

Another new product has been added to Armour's line of fatty acids. Already the manufacturer of the most complete line of high-purity distilled fatty acids that can be found anywhere, the Armour Chemical Division now offers low-temperature solvent crystallized oleic acid.

This exclusive process offers users of oleic acid a product that has advantages not found in ordinary distilled or pressed products. The extremely low temperatures employed guarantee a substantially lower saturated acid content than conventional types of oleic acid. In addition, solvent crystallized oleic acids are ester-free materials since the solvent used is not reactive with fatty acids. This new product is characterized by bland odor and has excellent heat stability.

Armour's low-titer White Oleic Acid meets U. S. Pharmacopeia specifications and is recommended for those uses that require a light color as well as a low titer. For textile applications that require a low titer but not a very light color, low-titer Distilled Red Oil is recommended.



Crystallization Unit at Armour's McCook Plant

White Oleic Acid
(Low Titer)

	Min.	Max.
Titer	—	5° C
Iodine No. (Wijs)	90	95
Acid Value	195	201
Saponification Value	195	201
Unsaponifiable	—	2%
Color (Lovibond 5¼" tubes)	—	1.5R-15Y

Distilled Red Oil
(Low Titer)

	Min.	Max.
Titer	—	5° C
Iodine No. (Wijs)	90	95
Acid Value	193	200
Saponification Value	193	200
Unsaponifiable	—	3%
Color (Lovibond 1¼" tubes)	—	8.0R-30Y

Armour's Oleic Acids are available in 55 gallon drums and aluminum tank cars. Write today for samples and prices.

Armour Chemical Division adds industrial oils to line

The Armour Chemical Division announced recently that it had taken over the supervision and sales of the Armour Industrial Oils Department. This move will greatly improve customer service by making available the facilities of Armour's Research Laboratory and the services of specially trained representatives to discuss customers' problems.

In the textile industry, the complete line of Industrial Oils offers producers of woolens and worsteds a wide selection of special-purpose fibre lubricants. Armour's Industrial Oils have outstanding stability during storage of goods and ready scourability with soap or soda ash.

Included in Armour's line of Industrial Oils for the textile industry are:

Specifications	Prime Lard Oil	Extra Winter Strained	No. 1 Lard Oil
Free Fatty Acid	1-2%	2-4%	15-20%
Pour Point (A.S.T.M.)	40-45°F.	40-45°F.	45-55°F.
N.P.A. Color	2 Max.	2½ Max.	5 Max.
Saponification Number	194-200	194-200	194-200
Iodine Number (Wijs)	70-75	70-75	70-75
SP. GR. 60°/60°F.	0.910 - 0.920	0.910 - 0.920	0.910 - 0.920
Viscosity (S.U. 100°F.)	190 - 210	190 - 210	190 - 210

Arquad 2HT excellent cationic textile softener

Armour's Arquad 2HT is a new cationic softener developed for use in textile finishing plants. It produces a full, soft hand with maximum lubricity and minimum reduction of absorbency.

As a cationic-active softener, Arquad 2HT is substantive to textile materials and can be readily exhausted onto cotton, rayon and wool from a long bath. As a result, Arquad 2HT can be applied most economically in the mill and the full value obtained.

Arquad 2HT is a distearyl dimethyl ammonium chloride. Its outstanding softening properties appear to be due to the presence of the two long fatty chains in the molecule. Arquad 2HT carries a positive charge which is naturally attracted to the negatively charged fabric. This leaves the fatty end exposed to contribute its qualities to the hand of the goods.

Arquad 2HT is compatible with certain finishing agents such as starches, dextrins, glue and gelatin. It can also be applied with most urea-formaldehyde and melamine-formaldehyde resin finishes including the new acid colloid resins.

Arquad 2HT is sold in 75% active concentration . . . packed in specially lined open-head drums holding approximately 400 pounds. Write today for additional information, pound samples, and price quotations.

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From one Monsanto department...

YOUR CHEMICAL DIRECTORY FOR RAYON AND SYNTHETICS

Sizing—Monsanto's Stymer S is being used on a broad scale for filament acetate, and now is gaining increased use on viscose. Stymer provides a tough, uniform, flexible size for the yarn; it carries off static electricity and provides good weaving properties. As a synthetic resin Stymer doesn't gel, so large mixes can be stored for long periods, and cleanup time is saved because Stymer won't clog pipes or valves. It doesn't build up on the dry cans.

Spinning—As in regular woolens and worsteds, Syton increases the yarn strength of *blends* spun on the woolen system. The use of Syton, colloidal dispersion of silica makes possible stronger and more uniform yarn. Stronger yarn means fewer ends down during spinning, with consequent production increases and labor time saved. Because of the increased yarn strength, it is also possible to spin closer to the limit spin and get increased fabric quality per pound of raw material.

Resin Finishing—Catalyst AC for both urea and melamine finishing offers a number of advantages. Resin baths are stable for considerably longer periods than those catalyzed with diamonium phosphate. Cure time is comparable or faster, and resin retention (measured after two washes) usually is greater. A number of mills have achieved an improved, softer hand on the finished goods through the use of Catalyst AC. And a number of mill men look upon Catalyst AC as insurance against some of the causes of odor.

Suitings—Wrinkle resistance by Resloom, Monsanto's melamine resin, has been very successful on the market on a wide number of constructions. Resloom provides a lively, springy hand which repels some wrinkles and sheds the rest. At the same time, Resloom provides durable washability on rayon fabrics.

Marquisettes—Crisp, durable finishes, with increased salability are provided by the Merlons, a series of styrene resin dispersions . . . each designed to give a specific effect on various fabrics and constructions. The Merlons can be combined with Santaloom, Monsanto's urea resin, to achieve a crisp finish, wrinkle resistance and washability.

Pilot plant slasher at Textile Chemicals Department laboratory.

Spuns—Durable crease resistance, and washability, is provided by the urea resin, Santaloom. Successfully applied, at low cost, on a wide variety of rayon constructions, Santaloom gives the *added* advantages of a fine, lively hand.

Dress Goods—The salability of rayon dress goods is further increased with the use of Monsanto's Merlons, styrene resin dispersions which give added body, and a "worsted-like" hand. The Merlons are a series of dispersions, which can be used separately or in combinations to produce a variety of effects on a given fabric. Generally, they provide a finish which is durable and low cost.

Flame Retardance—Rezgard A for viscose; and Rezgard E for acetate, are Monsanto's fugitive-type flame retardants. Durable to dry cleaning, the Rezgards do not alter tensile strength, hand, or other characteristics of the fabrics.

Slip Resistance—Monsanto's Syton, a dispersion of silica which promotes "inter-fiber drag," is also effective in controlling yarn slippage in underwear fabrics. Syton is effective on all types of synthetic and natural yarns.

Direct Dyed Goods—Monsanto's Dye Fixative 105 improves the wash fastness of direct-dyed goods and keeps the cost of the dyeing operation well within a low cost range. The dye fixative increases the color quality without adding substantially to the cost.

FOR INFORMATION PLEASE SEND THE COUPON

Serving the Textile industry

A FAMILY OF CHEMICALS FOR COTTON AND WOOL

COTTON

Piece Goods—Sted, Monsanto's non-sudsing detergent, is powerful yet chemically mild, and won't damage the most delicate fibers. Sted works well in hard water without softeners. Easy rinsing saves time, labor and helps prevent odor.

Flame Retardance—Monsanto's Rezgard A, specifically designed for cotton, meets New York City standards for fire retardants on textiles. Rezgard is a fugitive-type, and water soluble, although it is durable for considerable periods of time. Rezgard does not alter tensile strength, hand, or other characteristics.

Dyeing—A powerful wetting and scouring agent, Monsanto's Sterox proves effective as a dyeing assistant, for a growing number of cotton finishers. Sterox competes favorably with other detergents on a money-value basis.

Merlon—The salability of cotton is greatly increased by the use of the Merlons . . . Monsanto's series of water dispersible resin polymers. The Merlons provide a fine, crisp, durable hand on cotton sheetings . . . a percale-like finish for very little more than the cost of starch. Wear resistance also is improved.

Tickings—The Merlons improve hand, as on sheetings described above. In addition, a special Merlon formulation gives improved wear resistance on tickings.

Dress Goods and Suitings—Resloom, Monsanto's melamine resin, provides durable wrinkle resistance on a wide range of cotton constructions. Resloom has proved successful on millions of yards now in consumer hands; the cotton snubs some wrinkles and sheds the rest. In addition to wrinkle resistance, Resloom provides durable stability.

Direct Dyed Goods—Improved washfastness is gained by the use of Monsanto's Dye Fixative 105. In direct dyed goods, the dye fixative improves the quality without substantially raising the finishers' costs.

Reg. U. S. Pat. Off.: Stymer, Syton, Resloom, Merlon, Santaloom, Rezgard, Sted, Sterox.

WOOLENS & WORSTEDS

Stock—For the toughest cleaning jobs in the world, Monsanto offers two powerful detergents, Sterox in liquid form, Sted in drypowder form. Monsanto offers specific formulations for your particular cleaning problem. Both detergents are powerful and yet chemically mild, and *rinse easily* . . . saving time and labor.

Syton—Monsanto's colloidal dispersion increases yarn strength from 10%-to-30% depending upon the particular mill. Applied at the picker or gill box, Syton provides better carding, more uniform roping or roving. Because of increased strength, ends down are reduced and it's possible to spin closer to the limit spin. Mills, therefore, get the most value per pound of expensive stock.

Rug Yarns—In scouring rug yarns, Monsanto's Sted gives a uniform, clean base for dyeing. Its chemical action is mild, yet very powerful. Because it is non-sudsing, Sted rinses easily and mills consequently save operating time and labor.

Shirtings, Blankets—The foremost and outstanding method for wool shrinkage control. Woolens with Resloom washability are already on the market, and successful in the most exacting consumer tests. As many as 75 washes with less than 5% shrinkage. Through the new processes, Resloom can now be applied without investment in expensive curing equipment.

Woolen Suitings—Monsanto's Merlon, a series of styrene resin dispersions, gives added body to woolen suitings. Monsanto can recommend one of the Merlon dispersions exactly suited to individual wool fabric requirements.

Suitings—Resloom builds body into the fabric, in addition to washability. The bodying effect produces better drape and better tailor-ability . . . in addition to a hand which retains the fineness of traditional wool suitings.

Piece Goods—Monsanto's liquid-form Sterox is now used in continuous scouring systems for piece goods. Sterox is a powerful, yet chemically mild detergent, which *rinses easily* . . . and cleans thoroughly throughout without damaging the most delicate goods.

MONSANTO CHEMICAL CO. Textile Chemicals Dept., Desk ADT 40, Boston 49, Mass.

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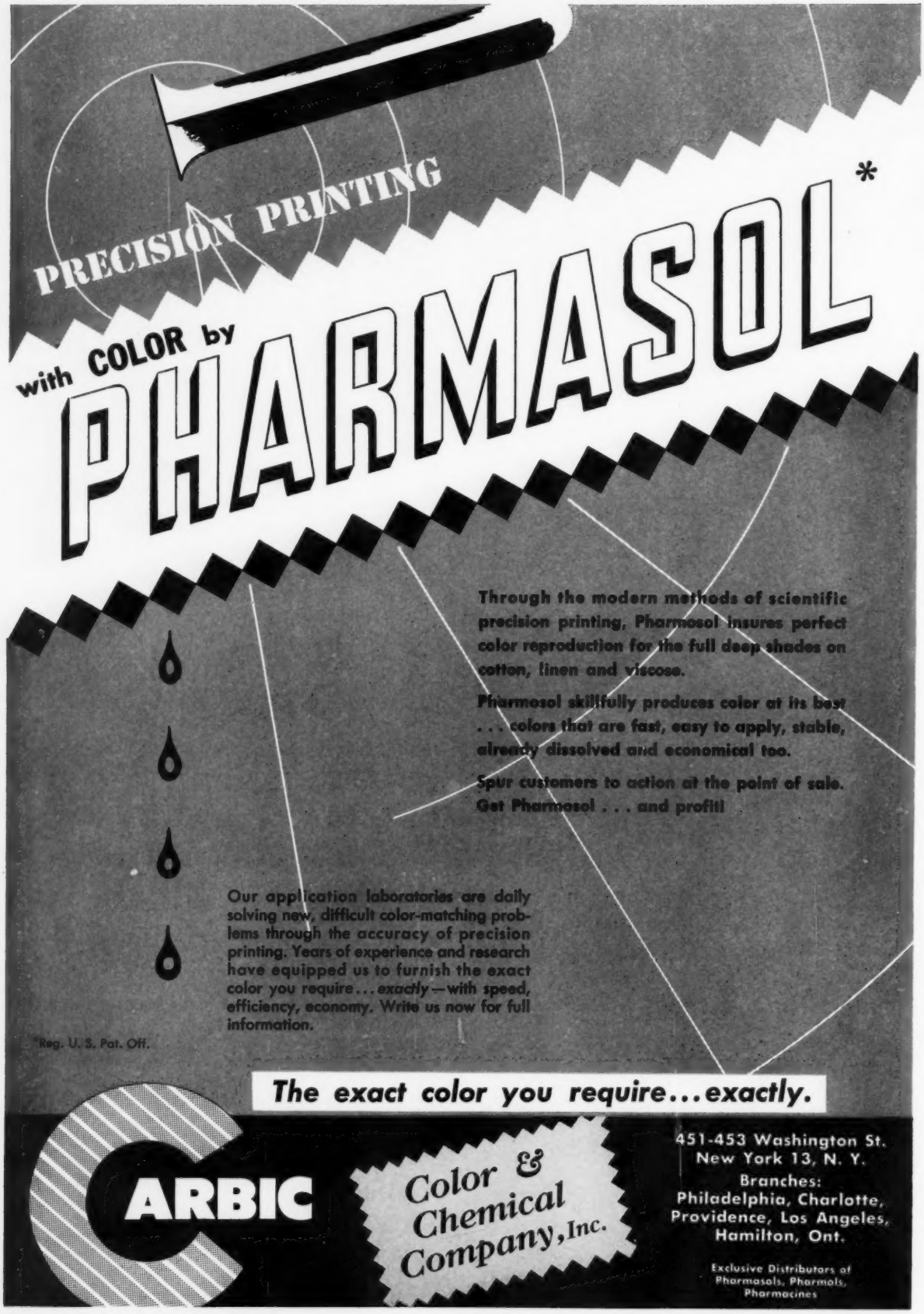
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Pharmasol skillfully produces color at its best . . . colors that are fast, easy to apply, stable, already dissolved and economical too.
Spur customers to action at the point of sale. Get Pharmasol . . . and profit!
Our application laboratories are daily solving new, difficult color-matching problems through the accuracy of precision printing. Years of experience and research have equipped us to furnish the exact color you require . . . exactly—with speed, efficiency, economy. Write us now for full information.
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Our application laboratories are daily solving new, difficult color matching problems through the accuracy of precision padding and printing. Years of experience and research have equipped us to furnish the exact color you require . . . *exactly* – with speed, efficiency, economy. Write us now for full information.

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SPECIFICATIONS

Groco 6 — White Oleine U. S. P.

Titre	4° — 7°C.
Cloud Point	39° — 45°F.
Color Lovibond 5¼" Red	1.0 — 2.0
Color Lovibond 5¼" Yellow	8 — 12
Unsaponifiable %	1.5% max.
Saponification Value	198 — 201
Acid Value	197 — 200
% F. F. A. as Oleic Acid	99.0 — 100.0
Iodine Value (WIJS)	89 — 92

THIS low titre White Oleine (U.S.P. Oleic Acid) is a multiple distilled product made entirely from selected animal fats. A. Gross & Company's modern distillation process yields a White Oleine superior in color, stability and free fatty acid content. *Write today for samples and also our new booklet, "Fatty Acids in Modern Industry."*

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XYNOFIX FL will give you prints like this every time!

Just use Xynofix FL in the last print wash. Even your most troublesome colors will "stay put"! You can also use Xynofix FL to prevent streaky goods when you face delays in your drying program. *Give Xynofix FL a test run!*

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CHICAGO • BOSTON • CHARLOTTE • ATLANTA

Smooth Supple Hand

LUPOMIN

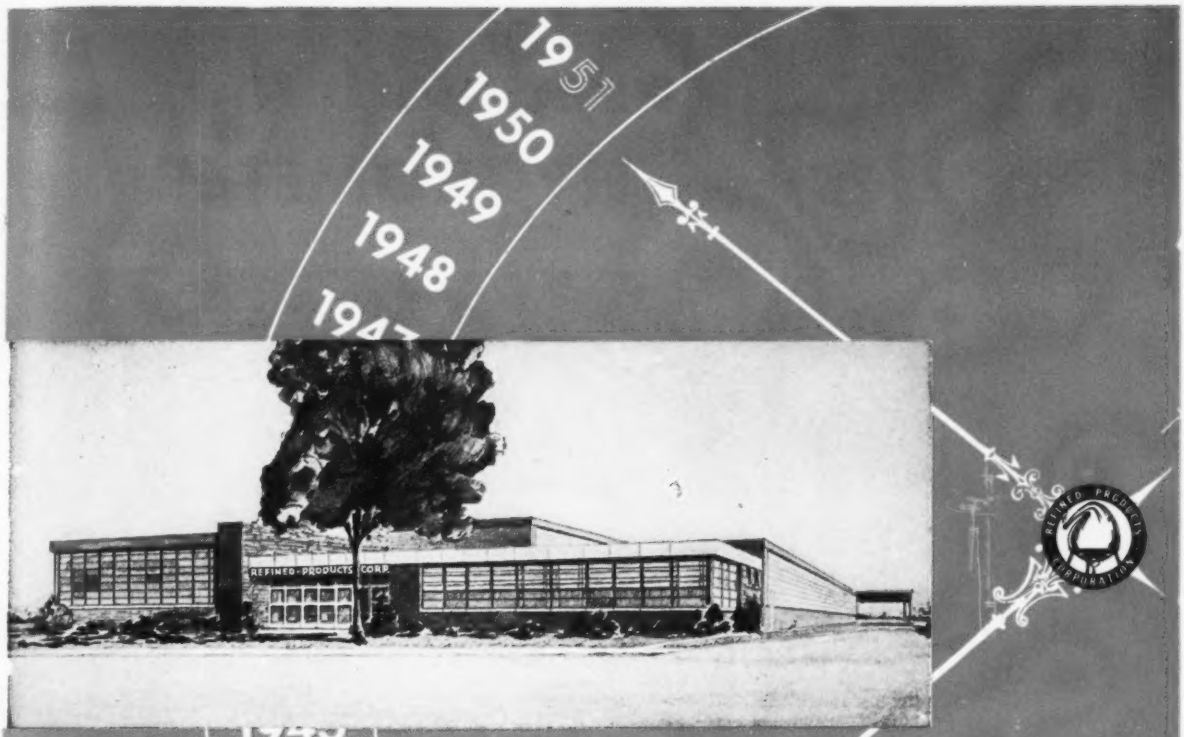
An Effective Cation Active Softening Agent for Uniform Finishes

Lupomin (Improved) is the latest development in textile softeners suitable for use on a wide range of fabrics. A very small quantity of Lupomin gives a supple and smooth hand and assures drapy fabrics with an odorless finish. Lupomin is equally effective in a neutral or acid bath and mixes with gelatine, gums, starches and dextrines. For brighter shades, fast colored discharges, Lupomin will save you time and money when used on cotton, linen, silk, wool, synthetic fibres and mixed fabrics. It is available in both paste and powder form. Complete data on the versatility of this effective softening agent as well as a sample for a test run may be had for the asking.

JACQUES WOLF & CO.
Chemicals PASSAIC, N. J.

Carlstadt, New Jersey
Los Angeles, California

FPG



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California Representative: SIDNEY SPRINGER, 2300 S. Vermont Ave., Los Angeles 7, California

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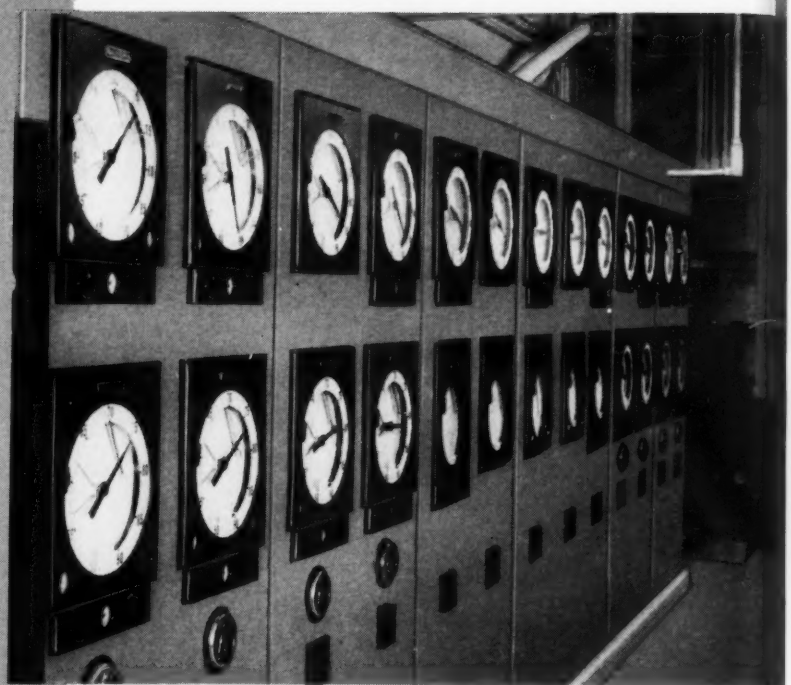

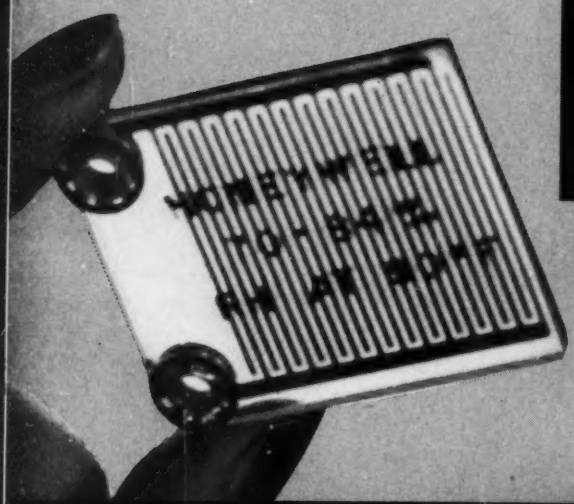

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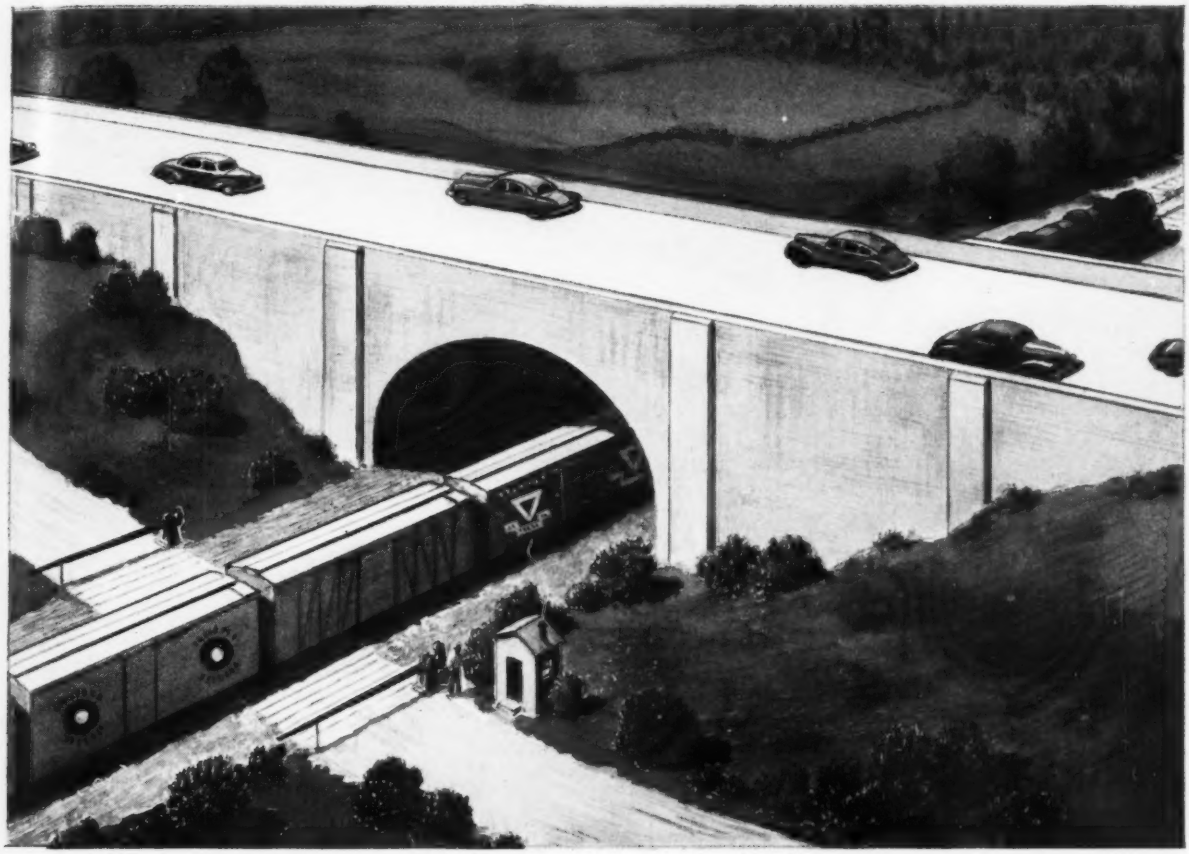

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JANUARY 22, 1951
VOLUME 40 NUMBER 2

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VOLUME 40 JANUARY 22, 1951 NUMBER 2

COPPER IN TEXTILES TO BE RUBBERIZED; PROPOSED NEW METHOD FOR DETERMINATION OF INJURIOUS COPPER

M. W. WEISS, ERIK HOFFMANN and SAMUEL LEE*
Interchemical Corporation, Hawthorne, N. J.

UNDER present specifications, textile products for rubber coating must not contain more than minute amounts of copper or manganese. The limits most commonly specified are 0.001% copper and 0.0005% manganese *(1, 2, 3, 4)*. Implicit in these limitations is the premise that any or all forms of these elements may be harmful to rubber. This view does not appear to be justified in the light of present knowledge. Although the following discussion deals only with copper, the necessity for differentiating between noninjurious and harmful compounds is probably applicable to manganese as well.

The effects of injurious copper compounds have been investigated extensively *(5)*. Even minute amounts may depolymerize raw rubber, making it soft and sticky; in vulcanized rubber they promote oxidation and accelerate aging, causing embrittlement with serious reduction in tensile strength and elasticity. Neoprene and GR-S synthetic rubber, as well as the natural product, are adversely affected *(6, 7)*.

It is generally accepted at present that only those copper compounds which are capable of dissociation or can form ionizable compounds under the conditions of vulcanization are potentially injurious. Salts, such as cupric sulfate and chloride, and soaps like the oleate, stearate or naphthenate are particularly injurious. Cuprous or cupric oxide, which may react with vulcanizing agents to form soluble, ionizable compounds, and cupric sulfide, which may oxidize to the sulfate, are likewise harmful. Fatty acids, and possibly other oily substances, promote the injurious effects of active copper compounds, probably by increasing their solubility in rubber. For this reason, it is also specified that the content of "grease", or material extractable with benzene, must not be over 1% in textiles offered for rubber coating.

As proof that the deleterious effects result from copper ions, it has been demonstrated that certain organic compounds which are capable of forming stable nonionic copper complexes are effective "inhibitors" or "deactivators." For example, copper oleate, which is very injurious to rubber, is rendered harmless in the presence of 8-quinolinol or mercaptobenzimidazol *(8)*. The injurious effects of traces of copper ions in promoting the oxidation of petroleum products is likewise counteracted by suitable organic deactivators *(9)*.

Harmful copper in textiles may originate in contamination from machinery parts such as dry cans or rolls, or as residues left in the goods after chemical processing (bleaching, scouring, dyeing, etc.) *(10, 11)*. With reasonable care in handling and processing, cotton goods containing less than the allowable maximum of ionizable copper and acceptable to the rubber coating industry can be produced without great difficulty.

Compounds in which the copper is not free to form ions are harmless to rubber. A prime example of such a compound is copper phthalocyanine, which possesses the structure shown in Figure 1.

The copper atom in this molecule is held by primary as well as secondary or "co-ordinated" valences, (the latter indicated by dotted lines) forming a "chelate ring." In this form, the copper cannot undergo the characteristic reactions of its ions. The well-known pigments Phthalocyanine Blue and Green, which have basically the above structure, are noted for their chemical stability.

In this connection, it is pertinent to quote from an authoritative discussion of the phthalocyanines published in 1939 by M. A. Dahlen of the DuPont Co. *(12)*:

"Copper phthalocyanine was adopted immediately in the rubber trade for the production of brilliant shades of blue, ranging from deep reddish blues to greenish pastel shades. The color is fast to all conditions of vulcanization, offers no difficulty due to migration, and broadly speaking, meets all the requirements of rubber processing. It is of particular interest that, although the pigment contains copper and that even traces of ionizable copper catalyze the destruction of rubber, copper phthalocyanine is without effect. This is striking proof of the 'tight' nitrogen to copper bond in the molecule."

Evidence confirming the above view was furnished as a result of an investigation by the Research Association of British Rubber Manufacturers, reported in 1947 *(13)*. Typical rubber vulcanizates, with and without Phthalocyanine Blue, were aged under various severe conditions. The tensile strength, elongation at rupture, and modulus of elasticity were tested before and after aging.

The copper compound had no appreciable detrimental effect on aging under any of the conditions tested. It was concluded that "copper can be present in extremely high percentages, yet do no harm to the aging properties of vulcanized rubber, provided it is rendered inert by chemical combination in certain types of compounds."

The copper phthalocyanines, as is well-known, are also among the most stable colorants for textiles and are extensively employed for this puppose. Under present specifications, however, no distinction

* Messrs. Weiss and Hoffmann are connected with the Research Laboratories. Mr. Lee is in the Textile Colors Division.

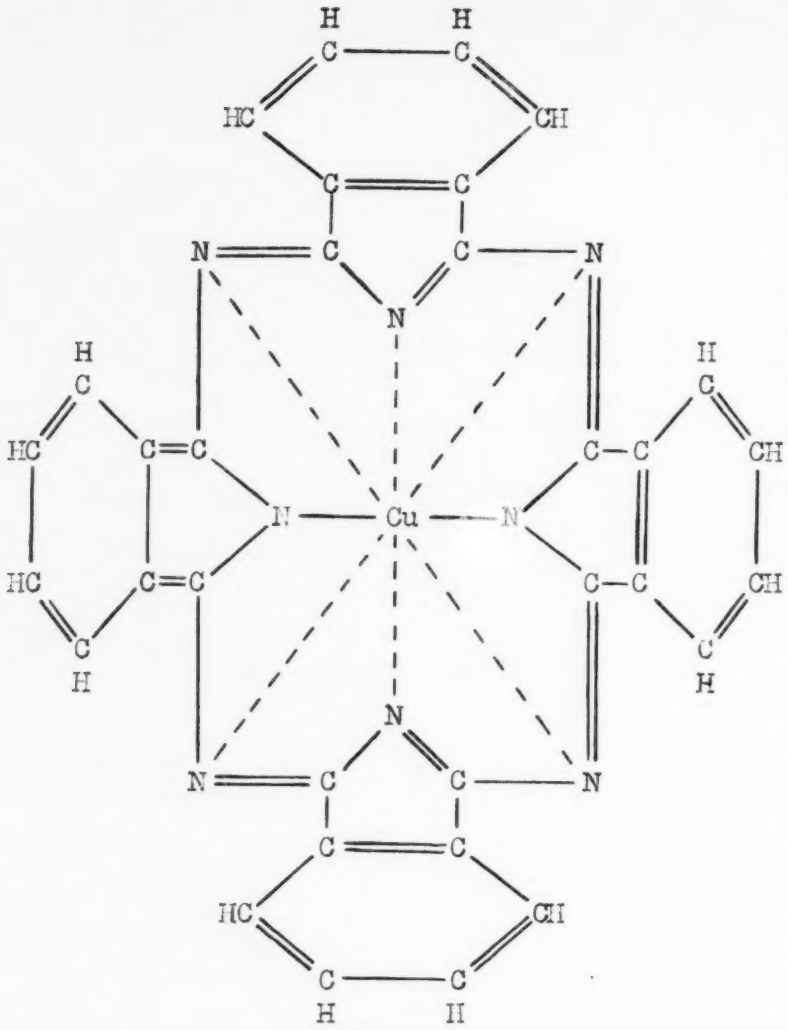

Figure 1
Copper Phthalocyanine

is made between harmless and injurious forms of copper, with regard to their effects on rubber. In consequence, any fabric containing copper colorants is considered unsuitable for rubberizing, even though, as in the case of copper phthalocyanine, the same pigment is actually employed for coloring rubber goods. It should be pointed out that the restrictions on copper content in textiles came into force before the phthalocyanines were made available to industry, and have remained essentially unchanged for a number of years.

In view of the fundamental chemical differences between the injurious and non-injurious types of copper, it should be possible to distinguish between them readily by suitable tests. Metallic copper and ionizable components likely to be present in textile products are readily soluble, for example, in dilute nitric acid. On the other hand, stable complex compounds such as copper phthalocyanine are not affected by dilute acids at room temperature, but require hot or concentrated reagents.

To demonstrate this point, cotton cloth printed with a Phthalocyanine Blue dispersion was treated with dilute (1 normal) nitric acid. The extract from printed areas contained only the trace amount of copper (approximately 0.0002%), which was obtainable from unprinted areas of the cloth, proving that the phthalocyanine had not undergone appreciable decomposition. However, when even small percentages of such compounds as cupric oxide, carbonate or sulfate, or cuprous oxide were incorporated in the phthalocyanine printing paste, their presence was readily detectable by a significant increase in the copper content of the nitric acid extract of the printed fabric.

The copper in complex or chelated compounds can be detected only after conversion to the ionic, soluble form, and all analytical methods of establishing the presence of this element are actually tests for copper ions. The current standard methods for testing fabrics involve the destruction of all organic matter by digestion with hot, concentrated oxidizing acid mixtures *(14, 15)*. Under these conditions, all the copper present is finally in the ionic condition, including that originally present as harmless compounds as well as injurious forms. Consequently, when destructive digestion is employed it is not possible to make any distinction between them. The use of hot oxidizing acid mixtures for destroying organic matter associated with copper was established long before the introduction of phthalocyanine colorants in the textile industry, but it has continued to be specified as the standard method for testing fabrics to be rubberized. It is obviously not suitable under present conditions.

A reliable analytical method for detecting and determining the content of injurious copper in textiles appears to be available, as a result of experiments carried out jointly at the Research Laboratory and the Textile Colors Division laboratory of Interchemical Corporation. Standard "80-square" cotton print cloth was employed. Cupric oxalate (C.P.) was incorporated in a printing paste which was applied to one piece by a laboratory printing machine. A dilute solution of copper stearate (commercial grade) in xylene was applied to another piece of cloth using a microset laboratory padder, and the solvent was evaporated by air-drying. A third piece was similarly treated with a dilute solution of commercial copper naphthenate in xylene and dried in the same way.

The actual copper content of each piece was determined on 5-gram samples by destructive digestion with boiling mixtures of nitric and sulfuric acids, followed by electrolytic deposition on platinum electrodes. Blank tests run on the same volumes of acids used in the determinations produced weighable amounts of copper which were deducted from the total to give the corrected copper content.

The copper content was also determined on each piece by extracting 5-gram samples with 1-normal nitric acid at room temperature. Aliquots of the extracts, containing 5-15 micrograms of copper, were made ammoniacal, treated with sodium diethyl dithiocarbamate reagent *(14)* and diluted in Nessler tubes to 100 ml. The copper content was estimated colorimetrically by comparison with a series of tubes prepared in the same way from aliquots of a standard copper sulfate solution, in steps differing by 1 microgram. Blank tests on the reagents were used to correct the results. The data from these tests are tabulated as follows:

COPPER CONTENT

Copper Compound on Print-Cloth	Hot Digestion-Electrolysis Method	Extraction-Colorimetric Method	Percentage of Copper Recovered by Extraction
Copper stearate	0.027%	0.029%	108
Copper Naphthenate	0.018%	0.017%	94
Copper Oxalate	0.038%	0.035%	92

The copper in these three water-insoluble compounds, which were present in small percentages dried into cotton cloth, was thus extractable with practically complete recovery by 1-normal nitric acid. It is unlikely that any copper compound potentially harmful to rubber would escape detection by this method.

These results appear to justify the proposal that extraction with dilute nitric acid should replace the hot acid digestion method in testing textile products for harmful copper.

The use of the following reagents and procedure is recommended for this purpose.

REAGENTS———

Nitric Acid, 1 Normal. 64 ml. (91 grams) of concentrated nitric acid (Specific Gravity 1.42), A.C.S. purity, diluted to 1 liter with copper-free distilled water.

Ammonium Hydroxide, Concentrated (A.C.S. grade).

Sodium Diethyl Dithiocarbamate Reagent. 1 gram of sodium diethyl dithiocarbamate (Eastman or equivalent purity) dissolved in 1 liter of water.

Standard Copper Solution. Dissolve 3.94 grams of copper sulfate crystals ($CuSO_4 . 5\ H_2O$), A.C.S. purity, in 100 ml. of distilled water containing 1 ml. of dilute (6-Normal) sulfuric acid, and dilute to 1 liter in a volumetric flask. Check the copper content of this solution by titration with 0.1 Normal sodium thiosulfate solution. Prepare the standard copper solution, containing 0.00001 gram (10 micrograms) of copper per milliliter, by diluting an aliquot.

PROCEDURE———Place a 5-gram sample in a 100 ml. Erlenmeyer flask fitted with a ground glass stopper, and add 50 ml. of 1 N nitric acid. Stopper the flask and shake vigorously to insure complete wetting of the sample, then allow it to stand 2-4 hours with occasional shaking. Pour the liquid into a 100 ml. beaker, and wash the sample with two 10 ml. portions of N nitric acid, adding these to the beaker.

Neutralize the solution with ammonium hydroxide, adding a slight excess. Heat just to boiling and allow to stand on a steam bath for at least one hour, to ensure complete precipitation of iron and aluminum hydroxides. Filter the solution while still hot, through a Gooch crucible with asbestos mat or a funnel with a sintered glass disk, collecting the filtrate in a 100 ml. Nessler tube. Wash the filter with 10 ml. of a 1% ammonia solution. After cooling the tube to room temperature, add 10 ml. of the diethyl dithiocarbamate reagent followed by distilled water to bring the level of solution to the 100 ml. mark.

Into a second 100 ml. Nessler tube, pipet 5 ml. of the standard copper solution and add 70 ml. of 1 N nitric acid. Make the solution slightly alkaline with concentrated ammonium hydroxide, add 10 ml. of carbamate reagent, and fill the tube to the mark with water. This solution contains 0.00005 g. (50 micrograms) of copper, equivalent to 0.001% in a 5-gram sample.

If the intensity of color in the tube containing the extract does not exceed that in the standard tube, the sample contains not over 0.001% of copper in a form harmful to rubber, and may be considered acceptable for rubberizing.

With suitable modifications, the same procedure may be employed for the determination of the actual content of harmful copper. In this case, the ammoniacal filtrate is collected in a volumetric flask, and aliquots are taken for colorimetric assay by any standard method *(14, 15, 16).* The sensitivity of the diethyl dithiocarbamate reagent permits the detection of 0.0001% of copper in a 5-gram sample, i.e., one-tenth or less of the maximum content allowable under present specifications *(16).*

As a rule, treatment of the nitric acid extract with ammonia, followed by filtration of any precipitate, will remove all substances which might interfere with the colorimetric procedure. However, if the extract contains a colorant not removed by the ammonia treatment it can be decolorized by digestion with hot oxidizing acids. Electrolytic deposition of the copper in colored solutions is an alternative possibility.

It should be emphasized that copper compounds which might be injurious to rubber are quantitatively extracted from textile samples by 1-Normal nitric acid at or near room temperature. Treatment at elevated temperatures is not only unnecessary but may actually result in appreciable decomposition of harmless copper compounds and thus give misleading results.

SUMMARY

It is generally recognized that although "free" or "ionic" copper, even in minute amounts, may be extremely injurious to rubber, the combined copper in certain textile colorants is essentially harmless. Present methods of testing involve the complete destruction of the sample and the conversion of harmless combined copper into the free form in order to permit detection and estimation. Such procedures, therefore, do not allow differentiation between free and combined copper, and thus, according to present specifications, classify as unsuitable for rubber coating any fabrics colored, for example, with phthalocyanine pigments. A method is proposed for detecting only the injurious copper in textile products, with ample sensitivity to meet present requirements.

ACKNOWLEDGMENT

The authors wish to express appreciation for the suggestions and criticisms of Dr. R. E. Rupp resulting from the evaluation of this procedure at the laboratories of Pacific Mills, Lyman, S. C.

REFERENCES

1. "Worth Street Rules," Specification P (1931).

2. U. S. Department of Commerce, Commercial Standards CS-32-31.

3. American Society of Testing Materials, Standard Specification D334-40 .

4. Rubber Manufacturers' Association "Standard Practices for the Sale of Coated Fabrics and Coating Services" 1949.

5. Rubber Growers' Association and Research Association of British Rubber Manufacturers, "Rubber—Physical and Chemical Properties", Croydon (England), 1935.

6. L. R. Mayo, R. S. Griffin, W. N. Keen, *Ind Eng. Chem.* 40 (1948) 1977.

7. A. M. Neal and P. Ottenkoff, *Ind. Eng. Chem.* 36 (1944), 350.

8. Y. Kawaoka, *J. Soc. Chem. Ind. Japan* 43 (1940) Suppl. Binding, 225.

9. R. W. Watson and T. B. Tom, *Ind. Eng. Chem.* 41 (1949) 918.

10. C. A. Seibert, *Am. Dyestuff Reptr.* 29 (1940) 736.

11. Kehren, *Melliand Textilber.* 20 (1939) 213.

12. M. A. Dahlen, *Ind. Eng. Chem.* 31 (1939) 839.

13. J. F. Morley, *J. Rubber Research* 16 (1947) 31.

14. A.A.T.C.C. "Analytical Methods for a Textile Laboratory" 1949, p. 58.

15. A.S.T.M. "Standards" 1949, Part 5, p. 152 (D-377-47T).

16. O. F. Palfrey, R. H. Hobert, A. F. Benning, I. W. Dobratz, Analytical Edition, *Ind. Eng. Chem.* 12 (1940) 94.

SPOT TEST ANALYSIS OF THE ASH OF NATURAL CELLULOSIC FIBERS

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Student at Lowell Textile Institute Graduate School

A system of spot tests has been developed for application to the ash of native cellulosic fibers. Each test is described and a short discussion of the chemistry involved is given. Experimental data are listed and discussed.

INTRODUCTION

A NEED exists for a simple system of tests, which may be applied to the ash of textile materials to determine the nature of any extraneous matter present.

Ordinary qualitative analysis has proven too demanding of time, amount of manual operation and size of sample. Furthermore, the entire sequence of operations must be followed if only to confirm the suspected presence of a single ion.

Analysis by means of spot tests seems to offer the most expedient method. In the perfect spot test analysis, several criteria must be attained. *First,* each test should be distinctive. Color changes should be sharp and unmistakable; precipitations should be distinct. *Second,* each test should be specific. The positive reaction should be given for only one of the ions possibly in the ash. *Third,* the test must have characteristics which will enable it to be carried out in the presence of other ions with no interference. *Fourth,* the time required for the test should be short, preferably a minute or less. *Fifth,* the manual operations involved should be simple. *Sixth,* there should be need for only common reagents and ordinary apparatus.

The author has experienced much difficulty in assembling a set of tests which meet the requirements above. In the majority of the tests, one or more of the factors are imperfect. The author feels, however, that the system is the best available at present and will serve as the basis for a more polished and catholic scheme.

Table I lists substances commonly used as finishing agents on cotton.

Tables II and III list the reagents and apparatus necessary in conducting the analysis.

TABLE I
SUBSTANCES COMMONLY USED AS FINISHING AGENTS ON COTTON
A. CLASSED ACCORDING TO CONSTITUTION

Borates: Antiseptics, flame-retardants
Phosphates: Flame-retardants
Chromium: Dyeing after-treatments
Sulfates: Dyes, softeners, antiseptics, after-treatments, flame-retardants
Tin: Mordants, flame-retardants
Antimony: Mordants, flame-retardants
Copper: Antiseptics, after-treatments
Zinc: Antiseptics, cellulose derivatives, flame-retardants
Aluminum: Mordants, flame-retardants, weighting agents, water-repellents
Zirconium: Water-repellents
Magnesium: Deliquescents
Calcium: Adhesives, deliquescents, weighting agents
Silica and Silicates: Flame-retardants, weighting agents
Fluosilicates: Antiseptics

B. CLASSED ACCORDING TO USE

Antiseptics: Borates, sulfates, fluosilicates, copper and zinc salts
Cellulose Derivatives: Zinc salts
Deliquescents: Calcium and magnesium salts
Dyes: Sulfates
Dyeing after-treatments: Sulfates, chromium and copper salts
Flame-retardants: Borates, phosphates, sulfates, silica and silicates, tin, zinc, antimony and aluminum salts
Mordants: Aluminum, antimony and tin salts
Softeners: Sulfates
Water-repellents: Aluminum and zirconium salts
Weighting agents: Silica and silicates, aluminum and calcium salts

EXAMINATION OF MATERIALS

The textile material to be analyzed should be tested for various use characteristics, such as color, hand, flame- and water-resistance, etc.

An intelligent interpretation of these characteristics is necessary for smooth operation of the analysis and equally intelligent interpretation of results.

The data gained from such an elementary examination may be sufficient to justify the use of only one or two tests, rather than following the sequence as listed below.

OPERATION AND DISCUSSION

GENERAL

A small quantity of sodium carbonate and two pellets of sodium hydroxide are

TABLE II
REAGENTS USED IN CONDUCTING SPOT TEST ANALYSIS OF THE ASH OF NATURAL CELLULOSIC FIBERS

Aluminon aqueous 0.1%
Ammonia aqueous concentrated
Ammonium Chloride 1% aqueous
Ammonium Mercury Thiocyanate aqueous*
Ammonium Molybdate aqueous**
Aniline
Barium Chloride aqueous
Benzene, Carbon Tetrachloride or Toluene
Benzidine 0.1% in 10% Acetic Acid
Cobalt salt 0.1% aqueous***
Ethanol 95%
Hydrochloric Acid concentrated
Litmus Paper, red and blue
Magnesium ribbon
Mercuric Chloride 1% aqueous
P-nitrobenzeneazoresorcinol 1% aqueous
Potassium Cyanide 5% aqueous
Potassium Ferrocyanide 1% aqueous
Potassium Thiocyanate 1% aqueous
Rhodamine B (C.I. #749) 0.01% aqueous
Sodium Carbonate crystals
Sodium Hydroxide pellets
Sodium Hydroxide 1N
Sodium Nitrite crystals
Sodium Oxalate 5% aqueous
Sodium Peroxide powder
Sulfuric Acid 6N
Turmeric Paper
Zinc Acetate 1% aqueous

* 8 g. mercuric chloride, 9 g. ammonium thiocyanate, 100 ml. water.
** 15 g. ammonium molybdate in 300 ml. water, add 100 ml. HNO_3 (1:2), saturate with ammonium nitrate.
*** sulfate, nitrate or chloride.
All liquid reagents should be kept in 50 ml. dropper bottles or similar vessels. Chemicals should be of C. P. or reagent grade.

TABLE III

APPARATUS USED IN CONDUCTING SPOT TEST ANALYSIS OF THE ASH OF NATURAL CELLULOSIC FIBERS

Glazed porcelain 12-hole spot plate
Porcelain crucibles #0
Porcelain crucibles #000 or 10 ml. beakers
Test tubes 3" x ⅜"
Burette funnels
Droppers or small bulbed pipettes—ca. 1 ml.
Watch glasses—ca. 2"
Wash bottle for distilled water
Platinum wire—ca. 5 cm.
Tongs
Evaporating dishes or casseroles—ca. 3"
Quantitative filter paper—e.g., Whatman #40
Glass rods
Beakers—ca. 150 ml.
Burners, stands, rings, gauze, triangles, etc.

Absolute cleanliness of equipment is a necessity. Some of the tests are sufficiently sensitive to show positive reactions for traces of contaminants.

added to the ash. The mixture is fused and cooled. To the cool mix is added 2-3 mls. concentrated hydrochloric acid. The bottom and sides of the crucible should be scratched firmly to break up lumps. When effervescence stops a bit of water is added. Sufficient acid is then added to take up any remaining carbonate. The mixture is filtered through Whatman #40 paper, the filtrate preserved, and the residue washed once with concentrated hydrochloric acid and several times with water. After washings are discarded, the residue and paper are set to dry.

The ignited oxides of such metals as chromium and aluminum exhibit great resistance to the usual solvents. The use of a flux is necessary before solution in acid. Fusion with sodium carbonate alone will not suffice, nor will fusion with potassium acid sulfate. It is neecssary that both an alkali carbonate and an alkali hydroxide be used.

Any residue present after filtration will consist mainly of silica. Washing the residue is necessary for two reasons: (a) some sodium chloride may be present in the residue because of the high concentration of this salt in the acid and it is best removed before making the test for silica and (b) the tests for phosphate and silica are essentially the same, utilizing the formation of complex ammonium molybdate salts and the subsequent oxidation of benzidine. If traces of soluble phosphate were left in a nonsilicious residue, the silica test would show positive results due to the residual phosphate.

The residue is dried only to aid in its separation from the filter paper.

SPECIFIC

BORATES———3-4 drops of filtrate are placed in a micro-crucible or 10 ml. beaker and are evaporated to dryness over a steam bath after which 2-3 drops 6N sulfuric acid are added. One drop of the mix is spotted on turmeric paper and is allowed to dry at room temperature. An orange to red color, which turns blue with 1N sodium hydroxide, is positive for borates. A blank must be run.

Boron, when present as boric acid, is capable of forming complex addition and coordination compounds with polyhydric alcohols. Boric acid functions as an intermediate in the conversion of yellow curcumin (see Fig. 1) into rosocyanine, a red-brown colored substance of indeterminate constitution. Analysis of the latter substance reveals that boron is totally absent. This reaction is used as the basis for the borate test.

Iron and zirconium form coordination compounds with curcumin which are also reddish brown. These substances, however, are stable to alkali while rosocyanine is converted to a blue-black salt, regenerating upon acidification.

Chromates and other oxidizing agents interfere in the reaction. It is for this reason that no sodium peroxide must be used in fusion.

(The author has found that exposure of acidified turmeric paper to heat will cause formation of a reddish color in the absence of borates. The test paper must therefore be dried at room temperature).

CHROMATES———2-3 drops of filtrate are mixed with an excess of sodium peroxide on a watch glass after which the glass is warmed over a wire gauze and stirred. The entire mix is spotted on a filter paper folded into four thicknesses. To the bottom or fourth layer is added one drop of benzidine in acetic acid. A blue color appearing within two or three minutes is positive for chromates.

Benzidine in acetic acid solution enters into redox reactions with many oxidizing agents, including chromates, to form the highly colored product benzidine blue (see Fig. 2).

Reaction of the test solution with sodium peroxide accomplishes two things: (a) the oxidation of Cr^{+3} to CrO_4^{-2} and (b) the formation of insoluble substances by the peroxide with other oxidizing agents present. Filtration through four thicknesses of paper effectively removes the residue, allowing for positive reaction only by chromates.

Benzidine in acetic acid solution is eventually oxidized to the colored merquinoid product by prolonged exposure to air. Therefore, a blue color appearing after two or three minutes must be disregarded.

PHOSPHATES———One drop of filtrate is spotted on filter paper with one drop of ammonium molybdate solution and then with one drop of benzidine in acetic acid after which the paper is held over an evaporating dish containing a few mls. of concentrated ammonia until the odor of acetic acid is replaced by that of ammonia. A bright blue color is positive for phosphates.

Alkali molybdates in acid solution exhibit little or no tendency to enter into redox reactions with reducing agents. The addition of some phosphoric acid, however, increases the oxidation potential of the molybdates enormously. The heteropolyacid so formed freely oxidizes benzidine to benzidine blue and is itself reduced to a lower oxide, molybdenum blue. The fact that both products are highly colored gives this test very high sensitivity.

Recent studies indicate that the following state of equilibrium is present (superscripts refer to the coordination numbers of the molybdenum atoms).

Mo^{+6} + benzidine $\rightleftarrows$ Mo^{+5} + benzidine blue.

Ordinarily the equilibrium lies far to the left. Upon introduction of phosphoric acid, the heteropolyacid $H_3PO_4.10MoO_3$ is formed, rather than $H_3PO_4.12MoO_3$, the substance previously thought to be formed. In the former, the coordination number of the molybdenum is five and the molybdenum-benzidine equilibrium is thrust far to the right since the Mo^{+5} is taken up (i.e., masked) as soon as it is formed. Oxidation of the benzidine occurs and reduction of the molybdenum acid to the blue lower oxide takes place.

Silicates, which enter into the same type of reactions, are removed in the initial filtration.

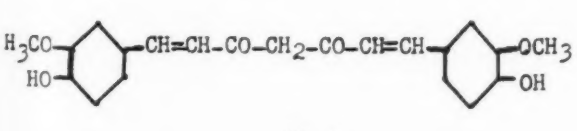

Fig. 1

Fig. 2

It must be remembered that this test for phosphate will show up the smallest of traces. Discretion is therefore necessary in estimating whether the phosphate is present as true extraneous matter or merely as a contaminant from nature.

SULFATES———2-3 drops of filtrate are placed in a small test tube. One ml. of water is added and then a drop of barium chloride solution after which 4-5 drops of benzene, carbon tetrachloride or toluene are then added and the mixture shaken. The test tube is allowed to stand until two separate phases have formed. The interface is then inspected. A white precipitate at the interface, or in cases of large amounts, a white turbidity in the aqueous phase is positive for sulfates. A blank must be run.

If a finely divided solid, insoluble in water and an organic solvent, is shaken in a mixture of these two liquids, each will be adsorbed to a certain degree on the surface of the solid particles. This adsorption of the liquids—or wetting of the solid particles—is caused by the lowering of the solid-liquid interfacial tension. When the interfacial tension of the solid for each of the liquids is less than the interfacial tension of the liquids for each other, the solid particles will collect at the liquid-liquid interface. This principle is utilized in the sulfate test, in which insoluble barium sulfate is collected at the water-organic liquid interface. The concentration of the solid on a plane of limited area, rather than in a volume of considerable space, facilitates the identification of the precipitate.

Again the analyst is warned that this method of interfacial collection will show up very small amounts of sulfate. Also, there is the danger that minute particles of water and/or benzene or other organic solvent will congregate at the interface without becoming assimilated into the parent phase. This may also occur with tiny air bubbles.

IRON———One drop of filtrate is placed in a depression in the spot plate. If phosphate was found present in large to medium amounts, a drop of ammonium molybdate is added. This is omitted if phosphate is absent or in traces. The drop is spotted with one drop of potassium thiocyanate solution. A pink to red color indicates contamination with iron.

Celluloses will not ordinarily contain iron compounds; however, it is practically impossible to process textile materials without some contamination by the metal occurring. Ferric ions will interfere with many of the following tests and it is therefore necessary to determine if they are present so that precautions may be taken.

The test depends upon the formation of the highly colored $Fe(CNS)_6^{-3}$ ion. Phosphates hinder the reaction, forming complex ferric phosphate ions. Addition of ammonium molybdate masks the phosphate since the equilibrium constant of phosphate-ammonium molybdate is greater than that of phosphate-ferric ion, the latter suffering to the former's benefit. The ferric ions, released from the complex, are then free to react with the thiocyanate.

ANTIMONY AND TIN———One drop of filtrate is placed on a watch glass to which is added a small piece of magnesium ribbon and enough hydrochloric acid to just dissolve the metal. One drop more of acid is then added. Dark colored flecks, spots or plates separating out are positive for antimony and/or tin. If the test is positive, the mixture is saved.

This test depends upon a simple reduction of any tin and/or antimony salts to the metals. The hydrogen formed by the acid dissolving the magnesium acts as the reducing agent. If the acid concentration is kept low enough, the tin will be reduced through the stannous state to the metal. It is important therefore that only that amount of acid be added to just dissolve the magnesium plus only one drop more. If too much acid is used, metallic tin will not plate out. Antimony, however, precipitates even in high acid concentrations.

TIN———If the Sn-Sb test (above) was positive, filter paper is impregnated with mercuric chloride solution and dried over a wire gauze. 2-3 drops of concentrated HCl are added to the mixture from the Sn-Sb test and one drop of the mix is spotted on the paper. The periphery of the drop is then spotted with one drop of aniline. A black, grey or dark brown color is positive for tin.

If, in the previous test, it was tin that precipitated, the HCl added will take up the metal as stannous ions. The familiar reduction of Hg^{+2} to Hg^{+1} is then effected with the stannous salt. In basic media the reduction is carried one step further and metallic mercury in a fine state of dispersion is precipitated. The black color is easily discerned.

$Antimony^{+3}$ will reduce mercurous salts to mercury in relatively strong basic media. Aniline is used, therefore, since its alkalinity is sufficient for the stannous reduction but not for the antimonous.

The author has found that if the aniline is spotted in the middle of the moist spot, an obscuring grey-white film is formed. The reagent is therefore added to the very periphery of the drop, the film of aniline salt forming mainly within the fibers of the paper and not on top, thus exerting no covering effect. The reaction, when positive for tin, will then show a dark line at the junction of the test solution and aniline areas.

ANTIMONY———If the Sn-Sb test was positive, one drop of filtrate, 2-3 drops of concentrated hydrochloric acid and a small crystal of sodium nitrite are mixed on a watch glass. One drop of this mixture is spotted on a drop of Rhodamine B solution on the spot plate. A change in color from light red to blue-red or violet is positive for antimony. A blank must be run.

Antimony V salts react with various xanthone dyestuffs to produce a bluish or violet color, destroying the natural red fluorescence of the dye. The bluish compounds are insoluble substances of unknown nature. The mechanics of the reaction are also unknown, though it is thought that an oxidation and a salt formation occur.

The analyst is warned that this test is unsatisfactory. The color change is often slight and sometimes practically impossible to interpret. It is, however, the only one which the author found could be used.

It is to be noted that the sodium nitrite is used for the purpose of oxidizing any trivalent antimony to the pentavalent form.

COPPER———One drop of filtrate is placed on the spot plate and is spotted successively with one drop sodium oxalate solution, one drop of zinc acetate solution and one drop of ammonium mercury thiocyanate solution. A rose to violet color or precipitate is positive for copper; a brown or orange color is not positive.

Zinc and copper salts give white and green precipitates respectively, with a solution of ammonium mercury thiocyanate . . . $(NH_4)_2Hg(CNS)_4$. When a mixture of copper and zinc ions is precipitated with the ammonium compound a violet substance is thrown down. It is thought that the violet precipitate is not merely a mixture of the zinc and copper salts since surface effects alone could not account for white and green mixing to violet. The compound is presumed to be a complex copper-zinc-mercury thiocyanate. Even traces of copper will color the precipitated zinc-mercury thiocyanate.

Ferric ions form zinc-mercury-thiocyanate complexes of violet colors also. When the ferric ions are present in minute amounts the precipitate is rose colored or light reddish brown. The sodium oxalate is added to mask the iron present, since even a short processing in an iron or steel vessel will contaminate textiles with ferric ions.

ZINC———One drop of filtrate is placed on the spot plate and is spotted successively with one drop sodium oxalate solution, one drop cobalt salt solution and one

drop ammonium mercury thiocyanate solution. The depression is vigorously scratched with a pointed glass rod for fifteen seconds. A blue color, cloud or precipitate appearing within two minutes is positive for zinc.

Just as zinc and copper salts form complex mercury thiocyanates, so do zinc and cobalt salts. The zinc-cobalt complex is a bright blue.

A cobalt salt solution of sufficient dilution must be used. If the concentration is greater than about 0.1%, cobalt-mercury-thiocyanate will separate out, this precipitate being the same bright blue as the cobalt zinc complex. Using a dilute cobalt solution, the cobalt salt will settle out only very slowly. It is for this reason that positive results are noted only within two minutes time. Vigorous scratching of the depression in the spot plate is necessary since the cobalt-zinc complex has a definite tendency toward super-saturation.

In this test as in the one for copper, ferric ions interfere. The sodium oxalate is thus a prophylactic agent.

ALUMINUM———Two drops of filtrate are placed in a small test tube and 1N NaOH is added until the mixture is basic to litmus. The liquid is filtered using a burette funnel. The filtrate is acidified with hydrochloric acid and a drop of aluminon reagent is added. After the solution is made basic with ammonia, a red to brownish red flocculent precipitate is positive for aluminum. The precipitate often collects at the surface of the liquid.

Aromatic o-hydroxy-carboxy compounds form chelated metallo-organic compounds with the hydrated oxides of most of the polyvalent metals. It is this principle, used in the mordant dyeing of textiles, which is used here for the detection of aluminum. Aluminon reagent, otherwise known as aurintricarboxylic acid or Chrome Violet (Geigy)—see Fig. 3—possesses the necessary groups in the proper orientations. The reaction with hydrated alumina is not at all specific, practically all other metallic oxides interfering. Use is made, however, of the amphiprotic nature of hydrated aluminum oxide. Separation with strong alkali is used, precipitating all other cations which might interfere.

Prior to use of the aluminon test, the Alizarin S reaction was tried. This compound forms lakes with many metallic oxides. The color change, indicating the presence of aluminum, is unsatisfactory in the extreme. It is absolutely impossible to correctly and constantly interpret the results, even when blanks and known aluminum salt solutions are run simultaneously in adjacent spot holes.

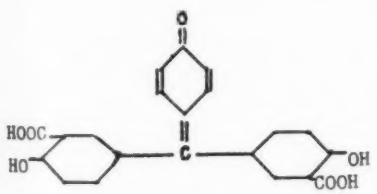

Fig. 3

MAGNESIUM———If iron, chromium, tin, aluminum, copper and zinc are absent, one drop of filtrate is placed in a depression in the spot plate. The drop is spotted with a drop of p-nitrobenzene-azoresorcinol solution and 1N NaOH is added until the yellow color disappears.

If copper and zinc are present, one drop of potassium cyanide solution is added before the sodium hydroxide. If iron, chromium, aluminum or tin are present, two drops of the filtrate are heated over a steam bath with a few crystals of sodium nitrite, using a small test tube. The solution is filtered using a burette funnel and one drop of the filtrate is used in the test for Mg as noted initially above.

A blue (not violet) color or precipitate is positive for Mg.

Magnesium hydroxide has a definite adsorptive property for certain organic dyestuffs. For those of the azo and anthraquinone series, there is a difference in color between the adsorption product and the nonadsorbed dyestuff. That a chemical reaction involving alkali effects the color change, rather than simple adsorption, is shown by the fact that MgO takes up dyestuffs in chloroform and other organic solvents without color change. Also, when ammonia or other weak bases are used instead of alkali hydroxides, the sensitivity of the test is sharply decreased.

This test cannot be carried out on spot paper, since the adsorption of the dye by the cellulose gives a deep blue color resembling that produced by magnesium.

Copper and zinc interfere in the test, as do iron, chromium, aluminum and tin. The first two ions may be masked by the use of potassium cyanide, complex metal-cyanide ions forming. The others may be precipitated as hydrated oxides by heating with sodium nitrite solution.

CALCIUM———The following is used only when iron is absent: One drop of filtrate is mixed in a small test tube with two drops of potassium ferrocyanide solution, two drops of ammonium chloride solution and two drops of ethanol and the tube viewed against a dark ground. A white crystalline precipitate or cloud is positive for calcium. A blank must be run.

This test utilizes the insolubility in even dilute solutions of calcium ammonium ferrocyanide. Magnesium ammonium ferrocyanide behaves similarly. However, it is doubtful if both calcium and magnesium would appear in one specimen of textile material. Therefore, if the test for magnesium is positive, the calcium test may usually be safely omitted.

This test is unsatisfactory mainly in one respect. . . ferric iron interferes, the ferrocyanide reacting preferentially with the latter metal. A reduction of ferric to ferrous iron previous to the test would preclude any interference. The author has not explored this possibility.

SILICA AND SILICATES———Small portions of the dried residue are taken up in a loop of platinum wire with sodium carbonate. The mix is fused in a flame and the operations repeated until a good bead has been formed. The glowing bead is immersed in 3-4 drops of ammonium molybdate solution on a watch glass and then heated to glowing again. This operation is repeated 3-4 times. The liquid is heated over a gauze until visible vapor is produced after which the mixture is spotted on filter paper with a drop of benzidine in acetic acid and developed over ammonia as in the phosphate test. A greenish-blue color is positive for silica and/or silicates.

Silicic acid behaves similarly to phosphoric acid in the enhancement of activity of various molybdenum complexes. Use is made of this fact in detecting silica by the benzidine-ammonium molybdate reaction.

Much time would be saved if the phosphate and silicate tests could both be carried out on the original acid solution prior to filtration. Oxalic acid destroys phosphomolybdates but has no effect upon silicomolybdates. . . tartaric acid has the opposite effect. Work was performed utilizing these reagents to determine if the phosphate and silicate tests could be made mutually exclusive. It was found, however, in good concentrations of both silica and phosphate, that if enough oxalic acid was used to mask the phosphate, it also masked the silicate. When only enough was used so that no masking occurred with the silicate, the phosphate also came down. Lack of time prevented a thorough investigation of the properties of tartaric acid on the reactions.

It should be noted that fusion with soda ash is utilized for the solubilization of the hydrated silica precipitated by the acid.

After immersing the bead in the molybdate solution, heat is necessary to form the silicomolybdate, no reaction taking place in the cold, as between phosphates and ammonium molybdate.

The silicate test is unsatisfactory in one respect. Traces or even fair amounts are bound to be found due to the etching action of alkali and soda ash on the porce-

TABLE IV
TRIAL DATA
FABRICS

ION:	I	II	III	IV	V	VI	A	B
BO_3	3A	2A	0	0	0	0	0	0
CrO_4	0	0	0	0	0	0	0	0
PO_4	1	3A	1	3A	*	0	1	1
SO_4	0	0	2A	0	1A	2	0	1
Fe	1	1	1	1	1A	1	1	1
Sn	0	0	0	0	0	0	0	0
Sb	0	0	0	0	0	0	0	0
Cu	0	0	0	0	0	0	0	0
Zn	0	0	0	0	0	0	0	0
Al	1	1	1	1	3A	2	1	1
Mg	0	0	0	0	0	0	0	0
Ca	0	0	0	0	0	0	0	0
SiO_2	1	1	1	1	1	1	1	1

3 = large amounts
2 = medium to small amounts
1 = traces
0 = negative

lain crucible in which the mixture is fused. The use of a platinum crucible would eliminate this contamination, but would add appreciably to the cost of the scheme. Therefore, when using porcelain crucibles, the analyst should run one blank in order to estimate the degree of contamination.

ZIRCONIUM———The author has been unable to devise or discover a test for zirconium which would be in any way suitable for use in this sequence.

FLUOSILICATE———One test was discovered in the literature applicable to the SiF_6^{-2} ion. Upon trying it, however, it failed to work. Sodium fluosilicate is seldom used, however, and then only as an antiseptic, so that the absence of a test for it need not be too keenly felt.

TRIAL DATA

Six samples of cotton fabric were tested. The first four were bleached print cloth. The last two were khaki dyed twill. Table IV lists the results of the analyses of the six samples and the two controls, A, the print goods, B, the twill. It should be noted that the controls are not grey cloth, but represent the fabric immediately prior to the application of the finishing agents.

Sample I was treated with borax and boric acid. Sample II was treated with sodium borophosphate, sample III with ammonium sulfate, IV with secondary sodium phosphate, V with alumina and wax and VI with an unknown zirconium compound.

With the exception of the zirconium compound, which was not available, the finishing agents themselves were tested. Only those tests were run on them which had yielded positive results on the finished fabric ash. In table IV those numbers standing alone indicate that the test for the ion was positive for the ash of the fabric but not for the finishing agent itself. An A following the number indicates that both the ash and the finishing agent gave positive results.

An asterisk indicates an anomalous result.

DISCUSSION OF TRIAL DATA

In samples I and III, as well as in both controls, phosphate was found present in traces. It is possible that the sensitivity of the test is sufficient to detect the traces normally present in the ash of raw cotton. Lack of time prevented an investigation of grey goods. The absence of phosphate in sample VI is due to formation of a stable phosphate-zirconium complex. The phosphate ions, so bound, are unable to enter into the molybdate redox reaction. In testing the alumina-wax mixture for phosphate, an anomalous reaction occurred. An intense blue color, fading within a few minutes, developed upon the addition of ammonium molybdate before any benzidine was added. It is obvious that some redox reaction took place. The reactants and the mechanics of the reaction are not known by the author. When sample V was tested for phosphate, medium amounts were indicated. In view of the peculiar reaction of the finishing agent under test, however, the indication is doubtful.

The presence of sulfate in traces in sample V is explained by its presence in the finishing agent itself. The zirconium compound used on sample VI was not available for test. Therefore, it may possibly be that the substance was a zirconium sulfate or that the zirconium compound was highly contaminated with sulfate.

The presence of ferric iron in all samples and in only one finishing agent tends to confirm the author's belief that contamination was caused by processing the goods in machines of ferrous alloy construction.

The results of the analyses might lead one to believe that the test in use is capable of detecting the aluminum naturally contained in cotton fibers. Such a conclusion is not justified at present. Further investigation is necessary. The moderate amounts of aluminum found in sample VI seem to indicate some interference by zirconium. No satisfactory explanation has been found in the literature.

The absence of silica in all the finishing agents tested and its presence in traces in all samples indicates that in the latter cases its presence is due to contamination by the porcelain crucibles. All fabric samples were naturally ashed and fused, while finishing agent samples were tested directly, without the use of crucibles. Natural cotton contains no silica. There is the questionable consideration, however, that colloidal silica may have been applied to the card sliver.

Calcium, magnesium and sulfate are present in very small quantities in raw and scoured cotton. The sensitivities of the tests described in this paper, however, are not sufficient to indicate the presence of these ions in such small concentrations.

CONCLUSION

The scheme represented in this paper is limited and deficient in many respects. Yet, the writer thinks that it will prove of value to the analyst in the textile testing laboratory. The proof of its worth rests in the hands of such analysts. It is for them to analyze various samples under differing conditions of technique, scrutinize the results and polish or revise unsatisfactory points. It is hoped that this paper may serve as a basis for developing a system of spot test analysis which will encompass all commercially used fibers.

REFERENCES

1. Feigl, Fritz "Chemistry of Specific, Selective and Sensitive Reactions," trans. by Oesper, R. E., 1st Eng. Ed., 1949.

2. Feigl, Fritz "Qualitative Analysis by Spot Tests," trans. by Matthews, J. W., 2nd Eng. Ed., 1939.

3. Skinkle, John H. "Textile Testing," 2nd Ed., Howes Publishing Co., New York, N. Y. 1949.

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THE WEBER-FECHNER LAW AND DYEING STRENGTHS*

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In a recent article, H. Cikurel showed that more nearly equal steps visually can be obtained in a series of dyeings at increasing strengths if the dye strengths of a single dye are increased logarithmically rather than arithmetically. This was claimed to be an application of the Weber-Fechner law relating stimulus to sensation.

Mr. Godlove points out, however, that there is not a strict relation between dye strength on a fiber and visual stimulus, and that therefore the Weber-Fechner law cannot be accurately employed to relate amount of dye on a fiber and equal visual steps.

IT was a pleasure to note, in the October 30 issue of the American Dyestuff Reporter *(1)*, that the student prize paper by H. Cikurel dealt with an application of psychophysical principles to textile dyeing; and, further, that the development of his thesis was ably executed by Mr. Cikurel. However, the paper contains one major error and some minor ones, which should be pointed out to prevent misunderstanding by readers of the article.

The Weber-Fechner Law has been correctly applied by the author to indicate that arithmetically equal steps of *stimulus* (assumed in the paper to be equal steps in percentage of dye strength) will probably yield unequal steps visually, and that geometrically equal steps of *stimulus* may yield equal steps visually. That is, of course, provided the "law" is universally valid, a subject about which more will be said shortly.

Though this, so far as it goes, may be true, *it does not go far enough*. What the author failed to point out is that dye strengths, assuming excellent exhaustion, are by no means accurate measures of the *stimulus*. The stimulus to vision is light; and for constant conditions of perception (background, etc.) the quantity of light is measured by the reflectance of the dyeing. The Cikurel prize paper tacitly assumes that dye strengths and reflectances are proportional, an assumption that is in fact rarely, if at all, true.

There are three, rather than two, quantities to be related: 1. Visual steps (Munsell's "value"), 2. reflectances of the dyeings, and 3. dyeing strengths. The Weber-Fechner law, insofar as it is valid, covers the relationship of quantities 1 and 2. The relation of quantities 2 and 3 is not in general a simple proportionality. Work done in the paper industry, based upon the fundamental work of Kubelka and Munk *(2)*, shows that for dyeings not too strong, dyeing strengths are more nearly proportional to the quantity $\frac{(1-R)^2}{2R}$, where R is the reflectance. The Calco Chemical Division of American Cyanamid Company showed that a similar relation can be applied to wool dyeings. We have long used such a relation, having successfully applied it to hundreds of dyeings in work done for a large textile mill. This function of reflectance has in fact proved so useful that a cam cut to yield this relation to reflectance is now sold as an accessory to the Hardy-General Electric Recording Spectrophotometer.

There is little doubt, as Mr. Cikurel states, that his geometrically stepped series of dye strengths looked better spaced visually than his arithmetically stepped series. But my colleagues, Charles Lawsberg, a dyer of many years experience, and Dr. Carl Z. Draves, the first well-known American exponent of spectrophotometry in the dyestuff industry, state that this fact was well known to them and others 25 years ago.

If the fact so stated is true, but was arrived at in the paper in question by incomplete reasoning, it becomes necessary to see why the paper's theoretical relation is apparently validated experimentally. A clue to the answer is found in a paper by the present reviewer *(3)*. There are found various equations for the relation between visual steps (Munsell "value" V) and stimulus percentage (reflectance R), both to fit the Munsell scale and earlier data. Some of these equations took account of the background reflectance, an important variable, which the Weber-Fechner law and Mr. Cikurel have neglected. According to the extensive Munsell data obtained by two very different but excellently checking methods, neither the Weber-Fechner logarithmic law nor the original "value-squared" law are valid for viewing on various backgrounds. The equations fitting both Munsell and earlier data show that for a white background, the correct relationship approximates to $V^2 = R$. For a black background, it tends toward the logarithmic relationship utilized by the famous chemist Ostwald and more recently by the *Color Harmony Manual* of the Container Corporation of America. The Munsell scale lies between, though for practical reasons the actual background paper for the Munsell charts is a light gray. The statement that both Ostwald and Munsell are "founded on the Weber-Fechner law" is therefore not strictly accurate.

The clue in the paper on "value scales" consists in the application of the various scales or formulas relating V and R to moderately small ranges of V or R. In such cases it is generally found that, within the precision usually found in visual experiments, it does not make much difference which scale or law is applied for small-range interpolation. Even a direct proportionality between V and R may be used if the range is quite small. The range of dyeing percentages in Cikurel's Table I is from 1.0% to 0.126%. We have not repeated his measurements, but from other measurements on the same and similar reds we are sure this range corresponds to at most two Munsell steps (18% difference in R at R around 20%) out of the ten steps from black to white. Over this range—and our *guess* is it would be less

* Communication received on Nov. 30, 1950.

—there is not much choice between a logarithmic, Munsell or squared-value scale. Perhaps even a direct proportionality, tacitly assumed by Cikurel, would not be much in error, and it is to be remembered that the precision of visual judgments in comparing the constancy of spacing in two scales of dyeings is not too good.

It is fairly well known that the Weber-Fechner law not only has a restricted range of validity, but in its simplest (logarithmic) form gets one into difficulties because the logarithm of zero is minus infinity, and a small positive value of R corresponds to an (impossible) negative value of V. This fact was in part responsible for attempts to find other laws to replace the Weber-Fechner law. In the paper on various scales, it was shown that two simple hypotheses as to how an observer picks the mid-value between two other visual values lead to either an exponential law relating V to R (proposed by Plateau) or to the logarithmic law. But the latter result is not the simple Weber-Fechner law; instead it is $V = c \log R + k$, where c and k are constants.

Cikurel correctly pointed out that the Weber-Fechner law leads to the fact that the "just noticeable difference" in R, expressed as a fraction of R, is a constant. Actually this is true for only a limited range. The constant is quite generally called the "Fechner constant", not the "Weber ratio", as stated in the Cikurel paper, though the latter is probably a more correct term.

Finally, we do not wish to detract from the value of the able execution of a good idea by the student Hanri Cikurel who brought into the dyeing literature phenomena well known elsewhere to explain a fact well known to dyers. Our discussion is intended to point out some possible misunderstandings, and show why logical reasoning, correct as far as it goes, but incomplete, may lead to a result at least approximately correct in fact.

REFERENCES

(1) Cikurel, H., *Am. Dyestuff Reptr.* 39, P736 (1950).

(2) Z. *tech Physik* 12, 593-601 (1931).

(3) Godlove, J. H., *J. Opt. Soc. Amer.* 23, 419 (1933).

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Piedmont Section to Meet in Greenville, Feb 3

PLANS have been completed for the February 3 meeting of the Piedmont Section to be held at the Poinsett Hotel, Greenville, S C. W Carl Wilcoxen of General Dyestuff Corporation (Greenville) is in charge of arrangements for the meeting. Following is the program:

11:00 A.M.—Research meeting conducted by Dr Harley Jennings. The exact room for this meeting will be on the bulletin board at the hotel. All officers are urged to attend, and any member interested in the research program is cordially invited.

1:00 P.M.—Officers Luncheon.

3:00-5:00 P.M.—Technical Session:

First paper: "Polyphosphates in Textile Processing" by Arthur H Razee, Manager of Chemical Sales and Service, Rumford Chemical Works, Rumford, Rhode Island.

Second paper: "The PPG-IDL Color Eye—The Instrument and its use in the Textile Industry," by George P Bentley, President of Instrument Development Laboratories, Inc., New York City.

7:00 P.M.—Banquet—Ball Room

Rev. Oran C Zaebst, Christ Church, Greenville, S C will speak on "The Hobby of 80,000 American People."

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Rhode Island Section Meeting Dates

THE following are the dates and places of the Rhode Island Section meetings for 1951:

January 26—Providence Engineering Society.

February 23—Johnson's Grill.

March 23—Providence Engineering Society.

April 27—Wannamoisett Country Club.

May 25—Johnson's Grill.

June 1—Outing—Wannamoisett Country Club.

October 26—Providence Engineering Society.

November 26—Johnson's Grill.

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Glenister and Searle to Highlight Mid-West Winter Meeting

THE Winter Meeting of the Mid-West Section will be held February 3 at the Morrison Hotel, Chicago, Ill, and will be built around the subject of purchasing and procurement.

The afternoon session, which will begin at 2:30, will deal with the problems facing the purchasing agent in today's chaotic market. The tentatively scheduled speaker is Don Glenister, assistant to the vice-president in charge of purchasing for Armour & Company.

The evening program, which will follow dinner, will feature Lieutenant Colonel V C Searle, Commanding officer of the Chicago Chemical Procurement District. His topic will be military procurement and the present procurement program.

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Report of Southeastern Section Meeting

THE Southeastern Section held its final meeting of the year 1950 in the Brittain Dining Hall of the Georgia School of Technology. After the dinner and business session, Dr R F Nickerson, Monsanto Chemical Company, gave a talk on "Some Recent Findings in Applied and Pure Textile Research." His talk was illustrated by means of a series of slides. There were 67 members and guests present.

Respectfully submitted,
RICHARD E HUDSON, JR, *Secretary*
(1950)

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Membership Applications

STUDENT

Richard K. Hall—Lowell Textile Inst., Lowell, Mass. Sponsor: E. E. Fickett.

Gregory J. Pelliccione—Lowell Textile Inst., Lowell, Mass. Sponsor: E. E. Fickett.

Raymond J. Quinn—Lowell Textile Inst., Lowell, Mass. Sponsor: E. E. Fickett.

Roger J. Sanborn—Lowell Textile Inst., Lowell, Mass. Sponsor: E. E. Fickett.

Jerome S. Schrager—Lowell Textile Inst., Lowell, Mass. Sponsor: E. E. Fickett.

William R. Smith—Lowell Textile Inst., Lowell, Mass. Sponsor: E. E. Fickett.

Kenneth E. Tanzer—Lowell Textile Inst., Lowell, Mass. Sponsor: E. E. Fickett.

Thomas C. H. Teng—Lowell Textile Inst., Lowell, Mass. Sponsor: E. E. Fickett.

Donald T. Wark—Lowell Textile Inst., Lowell, Mass. Sponsor: E. E. Fickett.

Ralph L. Wise—Lowell Textile Inst., Lowell, Mass. Sponsor: E. E. Fickett.

APPLICATION FOR TRANSFER TO SENIOR MEMBERSHIP

Hugh J. Bonino — *Henry G. Parrish*
Clifford S. Brenner — *Richard L. Stephens*
Ruth L. Galbraith — *Arthur C. Teichner*
James F. McAlister — *Martin H. West*
Anthony W. Visocki

CORPORATE

Dexter Chemical Corp, P O Box 1, Blvd Station, New York 59, N Y.

Premier Thread Co, P O Box 403, Pawtucket, R I.

SENIOR

Hyman G Abadi—Prod Mgr, Fabrica Nacional de Tejidos Lafayette, Bogota, Columbia. Sponsors: L S Little, L J Ross.

Midwest Section——

DYEING OF NEW SYNTHETIC FIBERS*

PAUL L MEUNIER
E I du Pont de Nemours & Co Inc

Orlon acrylic fiber, an addition polymer made by polymerizing acrylonitrile, has a moderate affinity for only three classes of dyestuffs under ordinary dyeing conditions, namely, acetate, vat and basic dyes. It may therefore be used advantageously as an undyed effect thread in the dyeing of piece goods. The author shows how carriers, swelling agents and high temperatures (212 and 250°F) may be used to increase the depth of dyeing of these colors on Orlon and also to extend the number of dyestuff classes that are applicable to Orlon. Staple Orlon has more affinity for all dyes than has filament Orlon.

Fiber V, new synthetic fiber produced from terephthalic acid and ethylene glycol, likewise has limited affinity for dyestuffs. The author explains how the three devices employed for increasing the affinity of Orlon may also be used to increase the dyeability of Fiber V.

ORLON acrylic fiber, and the experimental *Fiber V* are the newest members of the du Pont family of synthetic fibers. Both of these fibers appear to have great potentialities in a wide variety of textile uses.

GENERAL

ORLON ACRYLIC FIBER———Orlon acrylic fiber is produced from an addition polymer made by polymerizing acrylonitrile. It is now being manufactured at the May plant at Camden, SC. The output of this plant is continuous-filament yarn. A relatively small amount of fiberstock is also produced. The indicated uses of the continuous-filament yarn in the industrial field and in outdoor fabrics, where the desirable functional properties of Orlon are important, have been described thoroughly in a previous publication *(1)*. Some fiberstock finds its way into knit fabrics, such as socks and sweaters, as well as into work-clothing fabrics.

Orlon acrylic-fiber continuous filament possesses many outstanding properties. In addition to those recommending it for industrial and outdoor uses, Orlon has other desirable attributes, which designate it as an outstanding textile fiber. For example, taffeta and satin fabrics woven from the continuous-filament yarn have a warm, crisp and luxurious hand. Consequently, it is expected that this fiber will be used in apparel fabrics such as shirting, lingerie and fine dress goods.

The limited dyeability of Orlon continuous-filament yarn was described in our publication last fall *(2)*. Intensive research on the problem has resulted in the development of Orlon acrylic staple with greatly improved dyeability. It is indicated that staple fiber will be produced on a commercial scale at Camden in 1952.

ORLON ACRYLIC STAPLE———Orlon acrylic staple has exceptional bulking power, warmth, dry hand and good recovery from wrinkling. It is also dimensionally stable in varying humidities. This fiber will undoubtedly find wide application in suitings, dress goods, sportswear and blankets and in blends with other fibers.

FIBER V———Fiber V is still in the experimental stage. However, the development studies being carried out with this fiber stamp it as an outstanding candidate for honors in the wearing apparel field. This is the polyester fiber prepared by condensation polymerization of ethylene glycol and terephthalic acid. Continuous-filament Fiber V fabrics have good resistance to wrinkling and retain their good appearance with little ironing. This fiber appears to possess excellent properties in outerwear fabrics. In the staple form Fiber V has good resilience, dimensional stability, recovery from wrinkling and warmth. Fiber V exhibits good resistance to degradation by light and chemicals. Some applications in which Fiber V has shown great promise are the following: blouses, shirts, tropical suitings, and winterwear, sewing thread and window curtains. It also has good potentialities in fabrics of mixed-fiber construction, including mixtures with wool, nylon, viscose and acetate rayon.

DYEING OF ORLON ACRYLIC FIBER

CONTINUOUS FILAMENT———The relative water insensitivity of both Orlon acrylic fiber and Fiber V account for some of their desirable easy-living characteristics, such as quick drying, ease of washing and dimensional stability. But this water insensitivity is also responsible for their low order of dyeability. Consequently, a large amount of research is being carried out by the du Pont Company with three objectives:

1. Evaluation of all the available known dyestuffs.
2. Development of new dyeing techniques.
3. Development of new dyestuffs for these fibers.

Orlon continuous filament yarn exhibits reasonable affinity for only three classes of dyes: the dispersed acetate colors, vat dyes and basic dyes. (Certain oxidizable aromatic amines, or oxidation colors, also are absorbed by Orlon, but these are of minor interest). At conventional dyeing temperatures, however, the fiber is not even stained by most dyestuffs. This means that Orlon is a very good effect fiber. As the temperature of dyeing is raised, a critical dyeing temperature is approached at which the fiber becomes swollen sufficiently to absorb appreciable amounts of color. Unfortunately, this point is not reached until the temperature is in the neighborhood of 250°F, corresponding to a steam pressure of 15 psi. Consequently, research on this problem has followed the pattern of using steam or water at high temperatures (pressure dyeing) and/or dyebath assistants to promote swelling of the fiber.

In textile dye houses, the maximum obtainable temperature is 212°F, or slightly lower. Under these conditions, Orlon acrylic fiber can be dyed in light shades with dispersed acetate dyes, basic dyes and vat dyes. These shades would be suitable for the pinks, tea roses, grays and tans used in shirting and lingerie fabrics. By using assistants, such as phenolic compounds and aromatic amines,

* Presented before Midwest Section in Chicago on October 28, 1950.

especially meta-cresol and aniline, stronger dyeings are obtained, but they are still in the range of light shades. The Thermosol process, to be described later, which holds so much promise for dyeing Fiber V, fails to provide the depth of shade and fastness properties required for most of the intended uses of Orlon acrylic fiber.

A modified pad-steam method using pressure steam has been described in our previous publication *(2)*. However, this method is applicable only in laboratory apparatus because full-scale equipment required for steaming under high pressure is not available.

Four important improvements in the technology of dyeing Orlon continuous-filament fiber have been made since our initial paper on this subject. These are described briefly as follows:

1. Soluble vat colors may be applied to fabrics made of Orlon, as well as to yarns and fiberstock. While the depth of shade consistent with good fastness properties is limited to pastel and light shades, these colors exhibit excellent fastness to light and washing, properties that are vitally important for shirting and outerwear fabrics. On fabrics made of Orlon acrylic fiber, the soluble vat colors are applied simply by padding the fabric with a solution containing color and sodium nitrite. A short oxidation follows when the goods are treated with hydroxyacetic acid on a jig at 200°F. Drying after padding may be required in some cases to control migration. The dyeing of yarns and fiberstock is surprisingly simple. The material is treated for 30 minutes in a bath containing the soluble vat colors at 200°F, salted out with 50 grams of potassium chloride per liter and then rinsed with water. Following the rinsing, the dyed material is oxidized in a liquor containing sodium nitrite and hydroxyacetic acid at 212°F.

2. Insoluble vat colors in the form of vat acids have been applied with equal success on Orlon fabrics, yarns and fiberstock. In the case of fabrics, the vat acids are prepared in the usual manner and padded on the fiber, following which the material may be dried to insure level impregnation. The dried colors are oxidized by treatment on the jig at 200° to 212°F, with peroxide and hydroxyacetic acid or some other suitable oxidizing medium. The vat acids are dyed on yarns and fiberstock by treatment of these materials in the vat acid liquor for 30 minutes at 212°F, after which the dyed materials are rinsed and then oxidized at 200 to 212°F in a bath containing 2.5 grams of potassium dichromate and 2 grams of hydroxyacetic acid per liter. Absorption of the vat acids is increased considerably by the use of 2 grams of beta-naphthol per liter of dye bath. The naphthol is incorporated by being dissolved in the caustic solution used for vatting the color before formation of the vat acid. As a result, the beta-naphthol is present in the dye bath in the form of a dispersion.

Vat dyeings from either vat acids or soluble vat colors offer a very high degree of light and wash fastness. It is noteworthy that tan shades produced with both types on auto-top fabric made of Orlon acrylic fiber possess very good fastness to Fade-Ometer and weather exposure. Color selection is important, but the range of vat-color types applicable by either method is quite large.

3. There has been considerable demand for a black shade suitable for auto-top fabrics. We have developed a method of obtaining such shades by treatment of the fabrics made of Orlon on a closed jig with vat colors in the presence of high concentrations of color, caustic and hydrosulfite. The result is definitely a surface coloration of the Orlon fibers, which are damaged somewhat by this treatment. However, one mill trial has demonstrated that the damage is not excessive. The light fastness and weather fastness of the black shades produced in this manner are surprisingly good. Only the thioindigoid and indigoid types of vat colors build up and give dyeings of good depth with fairly good crocking fastness. Sulfanthrene Black PG Double Paste has been used effectively in this work. While the dyeing of Orlon with resin-bonded pigments is attractive for light shades, such as auto-top tan, heavier shades crock excessively. Moreover, a satisfactory black shade has not yet been produced with pigment colors.

4. The most important development in the dyeing of Orlon acrylic fiber is that of coloring yarn, sewing thread and fiberstock in aqueous baths under pressure at high temperatures. It has been found that modification of existing package machines converts them to pressure dyeing vessels capable of withstanding the desired pressure of 15 psi, corresponding to a temperature of 250°F. A conventional package-dyeing machine can be operated under pressure if the expansion tank is blocked off from the rest of the system after the dye liquor is introduced into the kier and all the lines are filled with liquor. The overflow pipe is also blocked off. By installation of a safety valve in the head of the kier set to discharge at about 45 lbs. psi, the machine is operated safely at 250°F, and liquor is circulated in both directions. The kier should be heated indirectly either by a steam jacket or a closed steam coil. *For safety reasons, a competent engineer should be consulted in regard to adapting commercial machines for this operation.*

At 250°F or above, the acetate colors yield fairly heavy shades, such as OD #7 and shoe brown. Selected vat colors of the thioindigoid class produce a full range of shades. Sewing thread made of Orlon dyed olive drab and black with vat colors is now being considered for outdoor use in fabrics for such purposes as army tents, awnings and auto tops. In addition, vat-dyed Orlon continuous-filament fiber is finding application as an effect thread in suiting fabrics, hosiery, etc. Following is a typical procedure for dyeing a full black shade on Orlon sewing thread:

Scour Orlon in a 1-lb package for 15 minutes with 2% Duponol Paste in a volume of 4 liters, and drop bath.

Vat 25% of Sulfanthrene Black PR Double Paste at 160° for 15 minutes in a volume of 1 liter with

15.0 g caustic soda,
15.0 g sodium hydrosulfite and
2.25 g Turkey Red Oil

Spring the machine with 3 liters of liquor containing

15.0 g caustic soda,
15.0 g sodium hydrosulfite,
2.25 g Turkey Red Oil
60.0 g Sulfoxite C, and
60.0 g potassium or sodium bicarbonate.

Circulate dye liquor for 30 minutes at 180° F.

Add 120 g potassium or sodium chloride and run for 1 hour at 250° F (pressure of 15 psi.)

Oxidize for 15 minutes at 212° F in a fresh liquor containing

5.0 g Albone C and
2.0 g 28% acetic acid per liter

Soap for 15 minutes at 212° F in a fresh bath with 5.0 g soap per liter.

ORLON ACRYLIC STAPLE

Orlon acrylic staple, which is now being developed, has markedly improved dyeing properties. This fiber is not only more receptive than than the continuous filament to dyeing with acetate, vat and basic dyes, but it is also dyeable with acid, chrome and direct colors. This immediately places it in the class of dyeable fibers suitable for wide textile uses. In its development program, Orlon acrylic staple has been used for suitings, dress goods, sweaters and socks. It has been dyed in a wide range of shades in fabric, yarn and rawstock form.

As Orlon staple exhibits its best dyeing behavior in the range of 200 to 212°F, it can be readily dyed in existing mill equipment. Although some slight benefits, such as improvements in yarn penetration, can be obtained by dyeing at raised temperatures under pressure, there is no need to resort to such unorthodox procedures.

At the present time, most of the Orlon staple dyeing is carried out with selected acid and chrome colors applied with sulfuric acid. These types are applicable to yarn, top, rawstock and piece goods in

conventional mill equipment. They afford good fastness properties throughout the range of shades. It is particularly noteworthy that all acid dyes on Orlon staple possess excellent wet fastness. Thus, it is believed that adequate dyeing and fastness will be obtained in suiting fabrics, especially when the Orlon is dyed in rawstock, top or yarn form with chrome and acid colors.

The dyeing of piece goods containing Orlon staple involves the problem of handling fabrics in rope form over a reel in closed equipment at raised temperatures. But as fabrics made of Orlon are somewhat heat sensitive, they form semipermanent creases during the dyeing. This leads to dye streaks, which will not level out. Two improvements have resulted from a study of this problem. One is the use of 5 grams of salicylic acid per liter as an assistant in the dyebath to allow dyeing at a lower temperaure and thus to reduce the hazard of crease formation. There is also some evidence that the assistant improves the levelness of dyeing. The other improvement is in the dyeing properties of the Orlon acrylic staple fiber, which promises to permit dyeing at lower temperatures with milder acids. It is believed that techniques for level dyeing of piece goods with acid colors will result from this work.

The dispersed acetate dyes are applied to Orlon acrylic staple from neutral baths in the same manner as they are dyed on cellulose acetate and nylon, except at higher temperatures. The outstanding property of these types is that of leveling at temperatures between 200 and 212°F. Despite the fact that they have this ability to "boil on and off" the fiber dyeings on Orlon with acetate colors exhibit very good washing fastness at 160°F. Nevertheless, acetate dyes are not considered desirable for most uses in staple fabrics for suiting, shirting and the like because of relatively poor light fastness.

Insoluble vat colors of the thioindigoid type and a few of the anthraquinone class have considerable affinity for Orlon staple when applied at temperatures near the boil. Many of these dyes are fast to light on Orlon, but they change shade in artificial light, thus presenting the problem of "flaring." At present, there are no dyes available for Orlon acrylic staple that can reduce this objectionable shade change sufficiently to warrant their use in suiting fabrics. However, there will be many instances where these dyes will be satisfactory in different end uses. Soluble vat dyes are of interest for Orlon acrylic staple for the same reason as that given previously in the discussion of the dyeing of continuous-filament fabrics. Shirting shades applied levelly with the soluble vat colors have desirable fastness to light and washing. Likewise, vat acids produce level shades, which are also fast to washing and light.

DYEING OF FIBER V

Fiber V is a new fiber, which is still in the experimental stage of development. However, there are many developmental studies being carried on in a variety of applications. The continuous-filament form of this fiber has a dry and warm hand with a certain degree of natural fiber crispness. It has shown considerable promise as a fiber for blouses, curtains, shirts, lingerie, sewing thread and several industrial fabrics. Fiber V staple, on the other hand, is the most resilient of all synthetic fibers. Consequently, a considerable amount of emphasis is being placed on the development of Fiber V staple in the suiting field, for example, in 100% Fiber V tropical-suiting fabrics and heavier constructions for winterwear and in blends with other fibers.

In regard to dyestuff absorption, Fiber V is rated between nylon and Orlon acrylic continuous-filament fiber. Actually, it is closer to nylon than to Orlon in this respect. The new fiber exhibits its greatest affinity for dispersed acetate dyes. Vat colors and certain naphthanil combinations dye Fiber V under pressure at high temperatures. Many types of colors are also applicable by the Thermosol dyeing process. None of the water-soluble dyes, including acid, chrome and direct colors, has affinity for this fiber.

Basically, there are three methods of dyeing Fiber V: aqueous dyeing at temperatures near the boil, aqueous pressure dyeing at temperatures above 212°F, and Thermosol dyeing, which involves heat treatment. It will be seen that all these methods depend on the swelling influences of water or steam at high temperatures, on carriers, or on dry heat.

AQUEOUS DYEING WITH CARRIERS———Like Orlon acrylic fiber, Fiber V responds to the swelling effect of water at high temperatures. In the dyeing of Fiber V with dispersed acetate colors in a neutral bath with soap, very little dyeing occurs until the temperature reaches 190°F, and most of the color is absorbed near the boil. Incidentally, Fiber V is a good effect fiber because of this resistance to dyeing with acetate and vat colors at ordinary temperatures, as well as its complete resistance to dyeing with acid, chrome and direct colors even at very high temperatures.

Fortunately, the effect of dyebath assistants or carriers is more pronounced for Fiber V than for Orlon. A carrier is defined as a chemical material that appears to carry dyestuffs from the aqueous dispersion to the fiber, thus displacing the equilibrium between dyebath and fiber in favor of dyestuff absorption. It seems to exert a fiber-swelling action at the same time, which is most important in permitting rapid diffusion of dye through the fiber.

The advantages of carriers in aqueous dyeing are as follows:

(1) Increase in total absorption of dye.

(2) Improvement in the leveling or transfer during dyeing.

(3) Attainment of the maximum fastness properties, especially to washing and sublimation.

The available dispersed acetate colors do not possess sufficient affinity for Fiber V for the production of deep shades without the use of a carrier. We do not mean to imply that a carrier is always required, but even in the application of light shades it is always beneficial for exhausting the dyestuff, leveling the shade and improving the penetration of individual fiber filaments.

The selection of a carrier has been a serious problem. Many chemical compounds improve dye absorption, but not all are desirable carriers for one reason or another. We cannot take the time now to describe our work on all the candidate carriers studied, but we can specify the properties of a desirable carrier. Besides improving dye absorption and levelness, the carrier should be easily removed from the fiber after dyeing and must not have any deleterious effect on light fastness. It must be safe and easy to handle. The last requirement automatically eliminates a great many candidates.

Benzoic acid and salicylic acid have been the favored carriers, particularly because they are not dangerous and are quite effective. However, in the concentrations required for carrier action, they are expensive and the search for cheaper, more effective materials is still going on.

In the development of Fiber V, we have been called upon to conduct mill dyeings of all types. Considerable success has been attained in dyeing staple yarns in package and skein form, staple suiting fabrics on closed becks and filament fabrics on closed jigs with benzoic acid as a carrier. In addition, small quantities of Fiber V top have been dyed successfully.

AQUEOUS PRESSURE DYEING——— As was pointed out in connection with Orlon acrylic fiber, conventional package-dyeing machines can be adapted for dyeing at temperatures around 250°F.

This is a very important development for Fiber V because dye exhaustion and penetration of the fibers are excellent at these temperatures and carriers are not required. Very good dyeings in a full range of shades have been obtained on sewing thread, on filament and staple yarns, and on rawstock. Several dyers in the trade are in the process of scaling up their facilities for handling large quantities of Fiber V in these forms. They are convinced that pressure dyeing is the most satisfactory and most economical method for Fiber V.

THERMOSOL PROCESS———The Thermosol process (3) is the simple method of padding textiles with solutions or dispersions of dyes, drying, and then giving the material a short dry-heat treatment for a few seconds at temperatures in the region of 400°F. The process is completed by soaping to remove any unfixed color. It is believed that the heat treatment causes a slight amount of plastic flow and swelling and thus allows the color to be absorbed quickly and efficiently.

Although many types of colors are absorbed under Thermosol conditions, acetate dyes and vat-color pigments are the most promising. Since vat pigments are fixed by this method without the usual reduction and oxidation development, they can be used in mixtures with acetate dyes. This mixing of two different types of dyes in a simultaneous application to one fiber is new. It means that light-fast members from both classes can be selected for application to Fiber V fabrics, for example, suiting materials, with the attainment of a higher degree of light fastness. Some suiting shades applied in this manner have been at least equal in light fastness to that of the best chrome-color combinations on wool. In this connection, we should also emphasize the fact that acetate dyes properly applied on Fiber V have excellent wet-fastness properties, and so do the vat colors.

The depth of shade obtainable with vat pigments by the Thermosol method is limited, and not all vat dyes penetrate this fiber. Nevertheless, there is a sufficient number of reds, violets, and browns to provide fast shading components required for combinations with fast-to-light acetate colors.

COLOR SELECTION———For aqueous dyeing, that is, carrier dyeing or dyeing under pressure, the acetate dyes provide the only available full line of shades. As stated above, pressure dyeing with naphthanil colors and vat dyes provides certain shades that may be of some interest.

The specific dyes that are recommended for use on Fiber V vary considerably with the depth of shade desired. The following colors have excellent leveling properties, but, because they sublime and stain effect threads during washing, they are recommended only for use in light to medium shades:

Acetamine Orange GR Conc 175%
Celanthrene Red Y Extra 200%
Celanthrene Red 3BN Conc

Another group of colors most suitable for medium to heavy shades, possessing good leveling properties with good fastness to staining of effects during washing and to sublimation are the following acetate dyes:

Celanthrene Fast Yellow GL Conc 300%
Acetamine Yellow CG
Acetamine Yellow N
Acetamine Scarlet B

A third group having excellent fastness to staining and to sublimation but not possessing good leveling properties are suitable only for heavy shades. They include:

Acetamine Fast Yellow 4RL
Acetamine Rubine B Conc 125%
Celanthrene Violet BGF

Among these colors, Celanthrene Red 3BN Conc, Celanthrene Fast Yellow GL Conc 300%, Acetamine Fast Yellow 4RL and Celanthrene Violet BGF exhibit outstanding light fastness. It will be noted that the range of colors shown does not include a green shade of blue. Unfortunately, most of the available blue dyestuffs of this shade have very poor light fastness on Fiber V. Research on this problem has already made considerable progress toward the development of greenish-blue dyes of exceptional light-fastness.

It is expected that a fully satisfactory range of dyestuffs will be available for all types of dyeing on Fiber V. As indicated above in the discussion on Thermosol dyeing, suiting shades on Fiber V have been produced in laboratory applications with light fastness at least equal to the best chrome color combinations on wool.

It is also interesting to note that there have been some instances wherein Florida sunlight exposures of Fiber V dyeings are less severe than Fade-Ometer exposures. Further studies of this phenomenon are going on simultaneously with the fabric-development work.

SUMMARY

The dyeing of Orlon acrylic fiber in continuous-filament and staple forms has been discussed. Several recent improvements in the dyeing of continuous filament include the application of vat acids, soluble vat colors and thioindigoid vat dyes applied at 212 and 250°F.

Orlon acrylic staple exhibits much greater affinity for dyes than the filament fiber. It is dyeable also with acid, chrome and direct colors under ordinary mill conditions. Acid and chrome dyes on Orlon acrylic staple exhibit very good wet-fastness and light-fastness properties, at least equal to the same colors applied to wool.

Fiber V in continuous-filament form and in the form of staple is dyeable at 212°F, with dispersed acetate colors in the presence of carriers. At higher temperatures in aqueous media, this fiber absorbs vat colors and certain naphthanil combinations. The new Thermosol process provides the means of mixing acetate dyes and vat-color pigments for improved light fastness.

BIBLIOGRAPHY

(1) Quig, J B, "Orlon Acrylic Fiber—A New Synthetic," *Papers of the Am Assoc of Textile Technologists* 4, 61 (March 1949)
(2) Thomas, R J and Meunier, P L, "The Dyeing of Orlon Acrylic Fiber and its use in Colored Textiles," *Am Dyestuff Reptr* 38, P925 (Dec 2, 1949)
(3) "Thermosol Process," *The Technical Bulletin* (du Pont) 5, (No 2, June, 1949)

EMPLOYMENT REGISTER

This column is open for two insertions per year, per member, without charge. Blanks can be obtained from, and filed with, the Secretary of the Association, Lowell Textile Institute, Lowell, Mass. It is understood that these will be open to inspection by prospective employers who can obtain further information from the Secretary.

50-52

Education: A.A. degree in chemistry.
Experience: Laboratory chemist and colorist, with executive responsibilities.
Age 40; married, references; position as dyer or chemist, in mill, South or West, preferred.

1-8, 1-22

51-1

Education: Penna. State College, B.S. Chem. Engg.
Experience: Chemist, dyer and textile printer, executive.
Age 42; married; references; east coast preferred.

1-22, 2-5

51-2

Education: Textile school.
Experience: bleacher, dyer, executive.
Age 68; married; references; retired but in good health; position on east coast desired.

1-22, 2-5

OBSERVATIONS ON THE PROPERTIES OF WOOL WITH PARTICULAR REFERENCE TO SCOURING*

A. C. GOODINGS
Ontario Research Foundation, Toronto, Canada

Efforts to elucidate the molecular structure of wool can be greatly assisted by a comparison of its properties with constitutionally simpler fibers, such as silk and nylon. Density considerations, for example, can be made to show that the wool molecule does not have a straight-chain configuration similar to that in silk.

In addition to differences in side-chain composition in wool, silk and nylon, the possibilities for hydrogen bond formation also differ in these fibers. A further feature in connection with structure is illustrated by nylon, which evidences incomplete penetration of the amorphous regions by water. Such an "accessibility factor" can be expected to have a considerable influence on fiber behaviour.

Scouring is an example of a surface action, and experiments show how difficult is the removal of mineral oil from wool by a conventional soap and soap scour. The same difficulties are not found with silk and nylon fabrics. Ease of removal of mineral oil from wool is, however, markedly influenced by the composition of the detergent liquor, as illustrated by the substitution of bicarbonate for carbonate in a soap and soda scour. Certain abnormalities in the behavior of wool towards mineral oil have been observed, including the effect of chlorination to render wool unshrinkable. The need for further quantitative studies in connection with detergent action is indicated.

TO be suitable for textile purposes a fiber must conform in a fairly exacting manner to numerous diverse requirements. The necessary properties are to some extent inter-related but by no means completely so, and it is not perhaps surprising that only a very few natural fibers have met with the necessary requirements in a sufficiently adequate degree to have become extensively employed in the textile field. Even among those that are widely used are to be recognized certain shortcomings, and, as our standards in the matter of textile products are raised, these deficiencies become more pronounced and certain remedial measures are attempted. Crease resistant finishes provide one such example.

Among natural fibers, and indeed among all fibers, natural or synthetic, wool possesses desirable properties in a peculiarly high degree. That is not to say that wool is the perfect fiber and could not be improved upon or that it does not provide its quota of trials to the textile processor. In certain directions it presents problems which, under a similar set of conditions, do not arise with other fibers. Wool does, however, possess certain valuable properties that differentiate it from other textile raw materials and render it rather unique in the field. It is not a simple fiber from either a chemical or physical standpoint, but its very complexity is perhaps something of an advantage. We are in effect presented with a higher order of architecture, and if by investigation we can learn to understand it and recognize the significance of the various structural members and their separate contributions to the whole, the way to the production of still better and more versatile synthetic materials may be indicated. Great assistance to efforts being made to unravel the complexities of wool is provided by the availability of constitutionally simpler fibers like silk and nylon, with which comparisons can very profitably be made.

In connection with some of what is to be discussed here, such comparisons will be drawn upon as an aid to the intrepretation of experimental findings.

DENSITY

The normal fiber is composed of regions of greater and lesser molecular order. Where the orderly arrangement of molecules is high, we reach what is referred to as a crystalline region, and, as in the case of simple crystalline substances, such uniformly ordered regions provide X-ray diffraction photographs capable of being analyzed.

When a textile fiber is immersed in water, water is absorbed and a swelling of the fiber takes place. The extent of the penetration of the fiber by water is a matter of some uncertainty, but there is evidence to show that water does not of itself enter the crystalline regions. In regions of lower molecular order than crystalline, which we class together as amorphous, there may be complete penetration, but there is no reason to assume that anything less well ordered than what is properly referred to as crystalline is necessarily capable of admitting water molecules. In the case of nylon, for example, there is evidence which indicates that only a portion of the amorphous region is penetrated when the filament is immersed in water. Where penetration of the amorphous region is complete or very high, the apparent density of the fiber in water approximates the crystalline density, and may even be slightly higher. The crystalline density of native cellulose, for example, has been calculated by Hermans *(1)* from the data of Mark to be 1.59 g. per c.c., while the value found for the apparent density in water of cotton and ramie is 1.61 g. per c.c.

The composition of silk is more closely akin to that of wool and may usefully be considered. X-ray diffraction data give us the size of the crystal lattice, but we do not know with precision the average residue weight. From the analytical information available, combined with other recent experimental findings on the probable composition of the silk crystal, we may be reasonably certain, however, that the average residue weight will not be far from the mean of that for glycine and alanine, namely 64. This permits calculation of the density of crystalline silk and gives a value of 1.42 g. per c.c. The apparent density in water of silk has been determined *(2)* and found to be 1.426, showing a close correspondence with the calculated crystalline density.

In the case of wool, the apparent density in water was measured by King *(3)* and a value of 1.40 g. per c.c. recorded. It may be assumed, therefore, that the density of crystalline wool keratin will approximate 1.40 g. per c.c. at a minimum, or be higher than this if penetration of the amorphous regions by water is incomplete. The amino-acid residues in

* Presented at the joint meeting of the Canadian Association of Textile Colourists and Chemists and the American Association of Textile Chemists and Colorists in Montreal, June, 1950.

wool keratin are, however, in the main much larger than those in silk, analytical data on the composition of wool protein giving an average residue weight of around 115. In view of this, the fact that the crystalline density of wool is close to that of silk and possibly higher is very significant. The main molecular chain in silk is known from X-ray diffraction data to assume an extended or straight chain configuration. It can readily be shown that the increased space requirements to accommodate the bulkier side chains in wool would, if the molecular configuration also followed the extended form as in silk, result in a lower density for crystalline wool keratin than crystalline silk fibroin. The fact that it is not as low as such calculations indicate it should be, suggests that the molecular configuration in wool must differ from the straight chain form present in silk, and differ in such a way as to permit an increase in density. The answer is to be found in a folded molecular chain structure of keratin first proposed by Astbury *(4)* on the basis of X-ray diffraction data for wool, which showed meridional reflections differing from those found in silk. Although density considerations can be employed to pursue still further useful argument on the structure of wool, it is not proposed to do so here but to turn instead to a brief consideration of certain other features of wool and comparison with other fibers.

STRUCTURAL CONSIDERATIONS

The various properties of fibers are, of course, expressions of their particular structures, chemical and physical, and similarities and differences between fibers are to be sought finally in terms of molecular constitution and configuration, and the structural pattern into which the individual molecules associate. Silk and wool are both protein fibers and may be usefully compared; the fact that wool is built up from cells, which is not the case in silk, need not concern us here. In chemical composition the difference between wool and silk lies in the particular amino-acid residues from which the long-chain molecules composing these fibers are built. The average amino-acid residue in wool is much heavier than that in silk, resulting from the side chains in the former fiber being larger and present in greater variety. Differences between wool and silk can therefore result from differences in chemical composition of the side chains, and a great deal in the behavior of wool has been attributed to this particular structural feature. The presence of cystine in wool, for example, giving rise to covalent cross linkages between adjacent molecular chains may be expected to provide certain rigidity and structural coherence and assert a definite influence on some properties, although it is suggested that the composition of side chains may be overemphasized in importance and insufficient recognition may be given to other structural features as an explanation of observed behavior. The composition of the main chain in silk and wool is, of course, similar, resulting from a linking together of α-amino acids. The configuration of this main chain in the wool molecule has been pointed out to be different from that of silk, in that it assumes a folded rather than an extended state. This folded molecular configuration is of course the basis of the long-range elasticity of wool, a feature not shared with any other fiber, natural or synthetic, at least up to the present time. A folded configuration must, however, have an influence in certain other directions. For example, the possibility for hydrogen bonding between adjacent molecular chains must be less with wool than with silk, giving rise to differences in structural pattern, which are likely to be important.

Nylon possesses a feature in common with wool and silk through the presence in its molecule of amido linkages. Whereas, however, the peptide linkages in the main chain of a protein are separated by one carbon atom only, the corresponding linkages in 66 nylon have alternately four and six carbon atoms between them. The possibilities for hydrogen bonds to form between adjacent chains in nylon are therefore less than in silk. Other reasons for differences in properties may also be anticipated. The carbon atoms in 66 nylon, other than those of the carbonyl groups, contribute only simple methylene groups with no complex or reactive side chains therefore occurring in this molecule. There are many similarities in the properties of silk or wool and nylon, however, as well as certain notable differences. For example, just as a reduced affinity for acid dyestuffs can be produced in wool by treatment under certain carbonizing conditions, so a similarly reduced affinity can result on silk and nylon under similar treatment with sulfuric acid at high temperature. On the other hand, wool and silk can readily be dissolved in hot caustic alkali, while nylon is highly resistant to breakdown under the same conditions.

A further point in connection with structure and its influence on properties is illustrated by the case of fibers and moisture. It has been pointed out that when cellulose and silk are immersed in water, the apparent density of the fiber approximates the crystalline density, indicating fairly complete penetration of the amorphous region. With 66 nylon, however, the apparent density in water is appreciably lower than the crystalline density, indicating that penetration in the amorphous region is not complete. It has been calculated from experimental data *(5)* that only approximately 25% of the total amorphous portion of 66 nylon is penetrated, and there is therefore in connection with amorphous regions what may be called an "accessibility factor". Obviously the degree of accessibility of a fiber to a reagent, including dyestuffs, can profoundly influence its properties. When moisture is absorbed by a fiber, the fiber swells, and the increased volume is approximately proportional to the amount of water taken up. This is true right up to saturation, and it is to be observed that, contrary to what was once thought, there is no large volume of space in a fiber which under suitable humidity conditions is available for water to fill. If the centers of attraction in the fiber for water molecules are close together, it can be readily understood that the separation of molecular chains in the fiber to an increased distance will occur more readily than if the attractive centers are more widely spaced. The inability of water to penetrate nylon more completely than it does is not improbably associated with this factor, and inaccessibility may comprise both the effect of a complete blocking off of molecules from entry to a region and an inability to cause swelling and provide space for themselves even though not so barred. Such a concept involves the structural pattern of the fiber as a whole, which includes the composition and configuration of the fiber molecule and its arrangement or association with adjacent molecules.

Some properties of a material are concerned only with behavior at a surface. These, however, reflect the structure involved in the material providing the surface, even though not evidencing a three dimensional aspect as in the case of a property such as rigidity for example. In connection with surface action it is proposed to discuss briefly some experiments on the scouring of wool, having particular reference to the removal of mineral oil. Some comparisons with other fibers will be made, and the results may be anticipated to the extent of pointing out that much of what is to be reported is behavior peculiar to wool.

SCOURING

In the manufacture of woolens and English-spun worsteds, oil is added to the wool to facilitate the operations of yarn manufacture. This oil has subsequently

to be removed from the fabric before dyeing and finishing are undertaken. A considerable variety of oils have been used by the textile industry for oiling wool, although olive oil or a high-grade lard oil were formerly regarded as the best to employ for worsted manufacture. Today there is much more being used in the way of blended and specially prepared oils, including oils that can readily be made to form an emulsion with water. It is obvious that mineral oils would be considered for the oiling of wool as possible alternatives to the use of saponifiable types, and today a considerable amount of mineral oil is so used, either in blend with other oils or as the base for specially prepared products. Mineral oil alone is not, however, a satisfactory wool oil. The chief reason for this unsuitability lies in the fact that, when applied to wool, serious difficulties arise in the subsequent removal of mineral oil by conventional scouring methods.

In the experiments to be described the behavior of mineral oil on wool in relation to scouring has been studied in most detail, although other oils and other types of textile material have also been included. The object of these studies did not have in view the working out of the best conditions of use for any particular type of oil or scouring technique but the more general aim of adding to our understanding of the mechanism of scouring. As it has developed it may perhaps in the end teach us more about the peculiarities and behavior of wool, which is why a description of these experiments is being introduced here. The story is not by any means complete, however, and rather than be guilty of too much speculation it is perhaps better to confine this account largely to observed experimental facts.

The technique adopted to obtain a sample of wool fabric oiled with a known weight of a particular oil was to apply the oil from ether solution uniformly over a sample of clean undyed wool fabric of suitable weight. Two methods of scouring were employed, one a laboratory-size model of a conventional type of dolly scouring machine, similar to the Detergency Comparator developed by the AATCC, and the other a means of simply agitating the sample in the detergent liquor in a rotating jar held under constant conditions of temperature. In the former procedure where squeeze rollers were employed, a strip of cloth weighing 25 g. was oiled with the necessary amount of oil, usually 10% of its weight, and allowed to rest for 24 hours prior to scouring, during which time all the ether evaporated off. The strip was then passed through the rollers of the scouring machine and the ends sewn together to give an endless belt. For most experiments the time of scouring was fixed at 15 minutes, followed by rinsing with water for 8 minutes from a jet playing on the fabric at a point near the nip of the rollers. A suds box underneath the squeeze rollers permitted the scour liquor to be run back into the scouring bowl, or during rinsing to have the rinse water run off to waste. Temperature was controlled by means of a regulated water bath surrounding the scouring bowls. A diagrammatic representation of the equipment is shown end view in Fig. 1. In the second method of scouring used, a 20-g. square of fabric was oiled from an ether solution and allowed to rest for 24 hours prior to scouring. The sample was then introduced into a gallon jar with one liter of scouring liquor, together with eight rubber balls to increase agitation. The jar and contents were rotated in an air thermostat for 20 minutes. The sample was then removed and rinsed under standardized conditions. A photograph of the apparatus is shown in Fig. 2. The temperature of the scour liquor was maintained at 110°F. in all experiments except where the effect of temperature was being studied.

In the roller scouring equipment, a fabric oiled with a triglyceride oil, such as olive oil, could have its oil content reduced to less than 0.5% residual oil on the weight of the fabric in the 15-minute scouring period. The second method, in which agitation only of the sample in the scour liquor occurs without the use of squeeze rollers, is somewhat milder in action and is useful for showing up small differences. Both methods give parallel results, but each has its own particular advantages for certain types of experiment. The actual results that will be quoted here were obtained by the second or "agitation" method of scouring, but it will be understood that similar results have been obtained with the roller scouring equipment, although with somewhat increased scouring efficiency. Experiments with different quantities of oil on the weight of the fabric indicated a 10% oil-

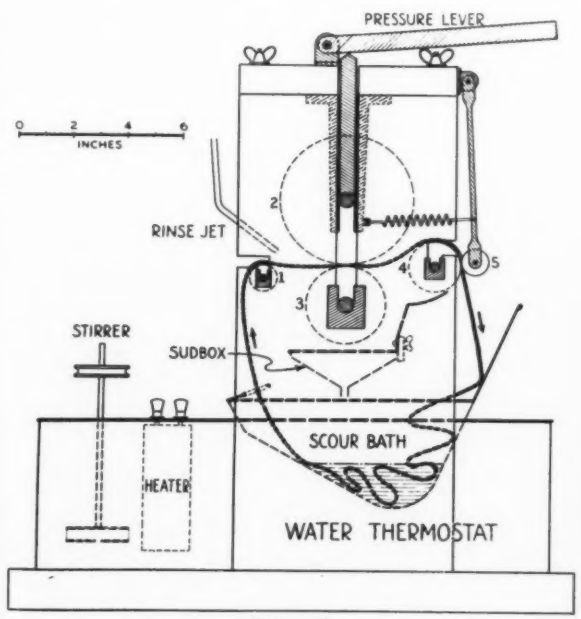


Figure 1
Experimental Scouring Machine

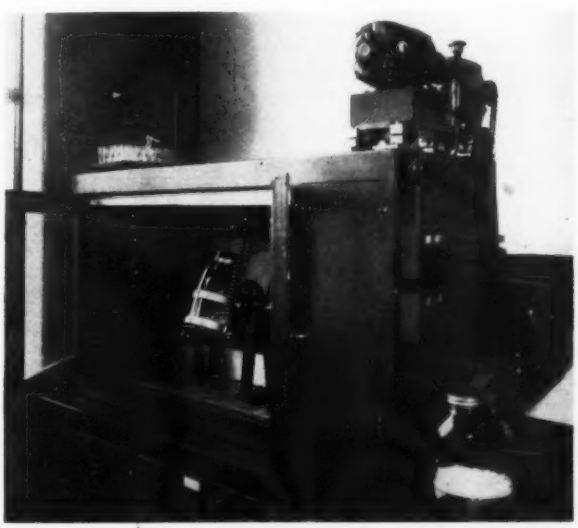


Figure 2

ing to be very suitable, and this was adopted as a standard practice in most cases. After the fabric was scoured and rinsed, it was allowed to dry, and its residual oil content was determined by ether extraction. In the presentation of results this residual oil is given as a percentage of the original weight of oil applied to the fabric rather than based on the weight of fabric. For a 10% oiling the latter are of course simply one-tenth of the recorded figures.

THE INFLUENCE OF TYPE OF OIL ———Mineral oil alone and in blend with olive oil was used to oil wool fabric, and scouring was carried out with a detergent solution containing 0.4% soap plus 0.2% soda-ash. In all cases the weight of detergent used was based on the volume of liquid, not on the weight of material being scoured. The results in terms of the residual oil left in the fabric after scouring are given in Table I and are shown graphically in Figure 3.

The difficulty in removing mineral oil by ordinary soap and soda scouring is immediately evident, and it is also to be noticed that blends with olive oil containing high percentages of mineral oil, although showing an increased ease of scouring over mineral oil alone, are likewise unsatisfactory in their degree of removal. It is to be pointed out that under the above fairly mild scouring conditions a residual oil figure of up to 15% may be expected to correspond to reasonably satisfactory scouring in the mill, and the limit to the amount of mineral oil to use with safety in such a blend would therefore be not more than 40%, and preferably somewhat less.

TABLE I

Oil Composition		Residual Oil %
mineral oil, %	plus olive oil, %	
100		86
90	10	71
80	20	65
70	30	40
60	40	29
40	60	14
20	80	10
	100	5

THE MODIFICATION OF MINERAL OIL———Although mineral oil alone is unsuited to the oiling of wool because of the difficulty associated with its removal, the addition of certain compounds in small quantity can completely alter the scouring properties. Such a compound, for example, may be a partially esterified fatty acid ester of glycerine, one of the so-called mono- and diglycerides, such as the diglyceride of coconut oil. Suitable selection among such compounds is necessary of course to obtain one that is liquid and miscible with mineral oil and will not separate and segregate when the oil blend is exposed to reduced temperatures. In a diglyceride, for example, two fatty acid radicals are combined with the glycerine leaving one hydroxyl group free, instead of each of the three hydroxyls being combined with fatty acid as in the normal triglyceride oils like olive, neatsfoot and lard oils. The influence on ease of scouring is striking in its effect, and is illustrated by the figures given in Table II. By way of comparison it should be observed that a 10% addition of the triglyceride olive oil effects a reduction in the residual oil value from 86% to only approximately 71%. As might be anticipated, one effect of the addition of a mono- or diglyceride to mineral oil is a very marked decrease in the interfacial tension of the oil against water or detergent solution.

TABLE II

Oil Composition	Residual Oil %
Pure mineral oil	86
2% diglyceride added	18
4% diglyceride added	8
6% diglyceride added	5
10% diglyceride added	4

It is clear, therefore, that mineral oils can be modified in scouring behavior by suitable additions so as to render them acceptable for textile purposes. Where an oil was formerly frequently judged on the basis of an unsaponifiable content, this is no longer a useful criterion of scouring ability, and an oil containing a high percentage of mineral oil may today be a perfectly satisfactory oil to use on wool.

It is of interest to mention in connection with the effect of partial esters of glycerine, that some accelerated aging tests on saponifiable oils, such as exposure of an oiled fabric in the Fade-Ometer, result in a large and rapid rise in the free-fatty-acid content accompanied by an increased ease of scouring, probably due, in part at least, to the formation of mono- and diglycerides. It is doubtful, however, that such accelerated tests duplicate the changes that occur in a trigly-

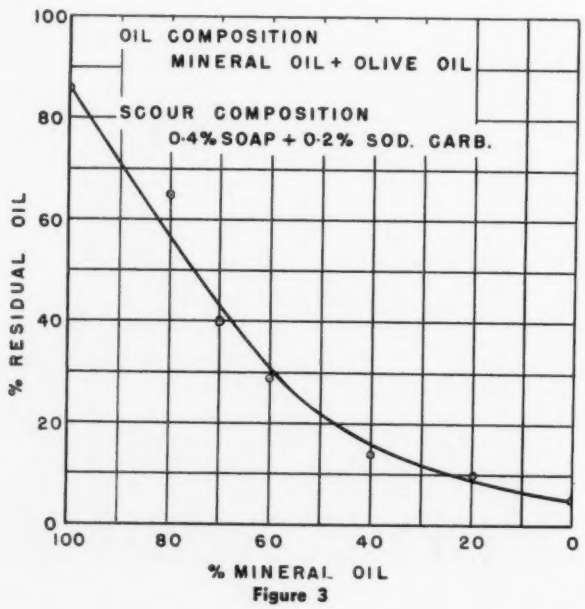


Figure 3

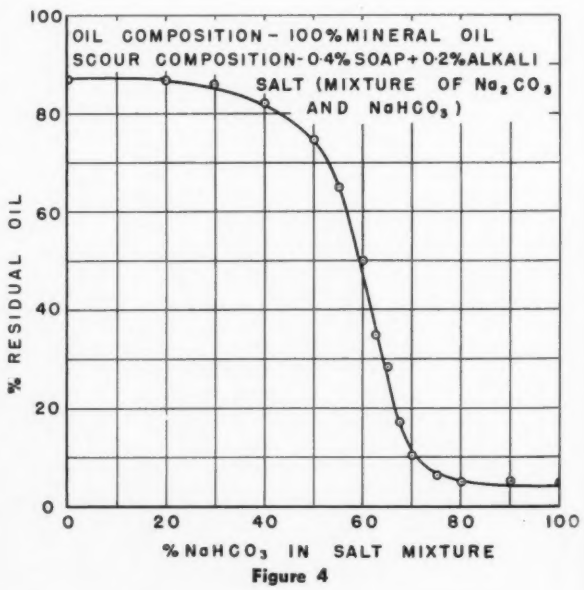


Figure 4

TABLE III

Detergent Composition	Residual Oil %
0.1% soap	91
0.2% soap	56
0.3% soap	8
0.4% soap	6

ceride oil under slower, natural aging conditions.

THE EFFECT OF DETERGENT COMPOSITION ON REMOVAL OF MINERAL OIL———Although mineral oil cannot be scoured satisfactorily off wool with a solution of soap and soda ash, omission of the latter salt results in a significantly different state of affairs. Table III shows results obtained for the residual oil left in the fabric when soap alone was used as the detergent solution.

Provided soap is present alone in a sufficiently high concentration, it is possible to remove mineral oil from wool, but the addition of even a small quantity of soda ash completely changes this result and scouring is inhibited.

It is obvious that the effect of the addition of other salts should be investigated, and some results in this direction can be illustrated from experiments in which sodium bicarbonate was employed. Detergent solutions containing 0.4% soap together with 0.2% alkali salt were made up in which the salt composition was varied from 100% soda ash to 100% sodium bicarbonate including a series of mixtures of the two. Results of scouring with these different compositions of detergent solution are given in Table IV and illustrated graphically in Fig. 4.

Similar curves are given by mixtures of mineral oil and olive oil but rising to a lower maximum residual oil content, dependent upon the composition of the oil.

It will be seen that the change from a condition where removal of oil is difficult to one where scouring is reasonably good takes place over a relatively small range of sodium salt composition. The curve is interesting because it offers possibilities for examination to determine whether a quantitative explanation of the change in detergent efficiency can be found in terms of the surface tensions of the oil and detergent solutions, the interfacial tension and the adhesion forces between the solid and the two liquids. Of additional interest in this connection is the fact that the curve obtained at a scouring temperature of 25°C., corresponding to that for 43°C. (110°F.) shown in Fig. 4, is displaced slightly to the left of the latter. Except for the two flattened portions at the ends of the curve, the same composition of detergent solution gives somewhat more efficient scouring at the lower temperature. The influence of other salts in conjunction with soap is also being investigated.

TABLE IV

Detergent composition: 0.4% soap + 0.2% sodium salt

Sodium Salt Composition		Residual Oil %
carbonate, %	plus bicarbonate, %	
100		87
80	20	87
70	30	86
60	40	82
50	50	75
45	55	65
40	60	50
37.5	62.5	35
35	65	29
32.5	67.5	17
30	70	11
25	75	7
20	80	5
10	90	6
	100	5

RATE OF SCOURING———In the experiments so far described, the results relate to a constant scouring time of 20 minutes. It is obviously of interest to know something of the rate at which oil is being removed from the fabric and whether, if scouring were continued for longer times, one might expect to remove considerably more oil. In the case of olive oil, the rate of removal is in all cases very rapid, and in the first few minutes a low value for the oil remaining on the fabric is reached, which longer scouring times diminishes only slightly. Mineral oil is appreciably slower in its rate of removal, and the influence of time is best illustrated by three cases in which the residual oil contents at the end of 20 minutes are high, intermediate and low. These correspond to the use of detergent solutions containing 0.4% soap plus 0.2% alkaline salt, the latter being sodium carbonate only, a 40/60 mixture of carbonate and bicarbonate, and bicarbonate only for A, B and C respectively. The results are given in Table V.

THE SCOURING OF FABRICS OTHER THAN WOOL———In view of the difficulty in scouring mineral oil from wool with a solution of soap and soda ash, it is of interest to observe the behavior with other fabrics, particularly silk and nylon, when similarly oiled and scoured. In the cases of silk, nylon and rayon oiled with 10% of their weight of mineral oil, the scouring efficiency was found to be markedly different from that of wool, the residual oil figures for each of these fabrics lying in the range of what may be considered efficient removal of oil. Although fabric construction may have some influence on the precise scouring result obtained, and the different fabrics used were not comparable in weight or sett of cloth, it is not to be anticipated that this factor is a dominant one. In this connecion it may be mentioned that experiments with wool fabrics of widely varying construction, including both woven and knitted materials, provided essentially similar results. Representative values for the residual oil remaining in the cloth after scouring may be quoted for silk, nylon and rayon as 10%, 6% and 1% respectively, the percentages as before being given on the basis of the original weight of oil applied. Of these three types of fabric, silk appeared to be most variable in its result, but in no case was a high residual oil value, comparable to that found for wool, encountered. Additional useful information could be obtained from a comparison of the scouring properties of fabrics made from spun and continuous-filament yarns of the same fiber.

ANOMALOUS EFFECTS ON WOOL———In the course of scouring experiments on various types of wool cloth, one sample of an all-wool white flannel was encountered that showed abnormal behavior. When oiled with mineral oil and scoured with a solution of soap and soda, instead of most of the oil remaining on the fabric the residual oil content was reduced to about 10% of the weight of oil originally applied. Extraction of the fabric with ether and alcohol prior to scouring did not change this result. The precise history of the cloth could not be ascertained beyond the fact that it was a carbonized material and that at the time of use it was still in a slightly acid state. It has since been observed that a wool fabric dyed in an acid bath, or subjected to the same conditions without the addition of dyestuff, would, despite normal rinsing, give an abnormally low residual oil value when oiled with mineral oil and scoured. If, however, treatment with am-

TABLE V

Detergent composition: (A) 0.4% soap + 0.2% sodium carbonate
(B) 0.4% soap + 0.08% carbonate + 0.12% bicarbonate
(C) 0.4% soap + 0.2% sodium bicarbonate

Time of Scouring	Residual Oil %		
Minutes	A	B	C
5	90	68	13
10	87	59	10
20	82	50	6
40	75	44	5
60	72	40	5

monia is introduced at some stage in the rinsing, the scouring behavior was caused to revert to that normally found in wool fabrics. It would appear that the condition of the fabric at the time of oiling can exert a profound influence on subsequent scouring. Preliminary experiments confirm this view and the need for further work in this connection is indicated.

It has been known for some time that wool which has been chlorinated to render it unshrinkable appears to possess the property of being more readily cleansed than ordinary wool. This was noticed particularly during the war in the case of grease contamination of wool clothing. Experiments were conducted in which chlorinated wool fabric, after-treated with bisufite and thoroughly rinsed, was oiled with mineral oil and scoured with soap and soda ash. A low (10%) residual-oil content after scouring was found to remain in all cases, substantiating the claim that oil can be much more readily removed from wool that has been given a chlorination treatment.

DISCUSSION

It has only been possible here to refer briefly to some of the more interesting experimental facts accumulated in a study of the scouring of wool fabrics, and the story as a whole, including conclusive reasons for the observed behavior, is as yet incomplete. A more detailed account of different phases of the work will be published in due course. The results in various directions would indicate, however, that the observed behavior of wool in the removal of oil by scouring is not primarily attributable to external macroscopic physical features of the fiber. If chemical composition and molecular structure are involved, the question arises, pertinent to a surface action, of the differences between wool and silk. The influence that prior treatment can have on the behavior of wool itself in connection with removal of mineral oil is very striking, and clearly indicates irregularities that may be encountered in scouring experiments on wool fabrics of unknown origin. It is also clear that certain precautions need to be taken in the selection of wool fabric where this is to be used in detergency studies.

The structure of wool in all its detail is not yet known, and the full implications of the structure even so far as we do know it are not as yet perhaps thoroughly understood. It is pertinent to ask, for instance, "why does wool keratin assume a folded molecular configuration while silk fibroin does not, and, as an outcome of this difference in the structural bodies of these two proteins, what other differences in behavior are attributable to it, directly or indirectly?" Some attempt has been made here to indicate how a study of other fibers and a comparison of their properties and behavior with wool can help us to achieve a better understanding of that more complex fiber, whose secrets can in turn perhaps provide us with useful knowledge to apply in the future production of improved synthetic products. There is reason to believe, for example, that the time is not far distant when we may be able to produce synthetic fibers possessing a folded molecular configuration as in wool, with something of that fiber's valuable long-range elastic qualities. If the dyer today finds that each new fiber which is developed adds a quota of troubles to his already heavy burden, perhaps he can take some small comfort from the fact that, partly as a result of what he is suffering, we are in the end the more likely to reach a state of knowledgable understanding of all that is associated with textiles and textile processing.

REFERENCES

(1) Hermans, P. H., *Contributions to the Physics of Cellulose* (Elsevier) p. 64.

(2) Goodings, A. C., and Turl, L. H., *J. Textile Inst.* 31, T60 (1940).

(3) King, A. T., *J. Textile Inst.* 17, T53 (1926).

(4) Astbury, W. T., and Street, A., *Phil. Trans. Roy Soc. A.* 230, 75 (1931).

(5) Abbott, N. J., and Goodings, A. C., *J. Textile Inst.* 40, T232 (1949).

CALENDAR

COUNCIL

April 20 (Raleigh, N. C.), June 15 (Hotel New Yorker, New York), October 18 (Hotel Statler, New York), November 16 (Hotel New Yorker, New York).

GENERAL RESEARCH COMMITTEE

April 20 (Raleigh, N. C.), June 15 (Hotel New Yorker, New York), October 18 (Hotel Statler, New York), November 16 (Hotel New Yorker, New York).

NATIONAL CONVENTIONS

1951: October 17-18-19, Statler, New York.
1952: Nov. 6-8, Boston.
1953: September, Chicago.

HUDSON-MOHAWK SECTION

Meetings: Mar. 16 (Albany), May 11 (Albany), June 22 (Annual Outing).

MIDWEST SECTION

Meetings: February 3 (Morrison Hotel, Chicago), May 5 (Hotel Schroeder, Milwaukee), June 16 (Outing, Lake Lawn Lodge, Delavan, Wis.), September 29 (Morrison Hotel (Chicago).

NEW YORK SECTION

Meetings: Feb. 23 (Hotel New Yorker), March 30 (Swiss Chalet), May 4 (Swiss Chalet), June 15 (Outing).

NORTHERN NEW ENGLAND SECTION

Meeting: Jan. 26 (Hotel Commander, Cambridge, Mass.).

PACIFIC SOUTHWEST SECTION

Meeting: Jan. 26.

PIEDMONT SECTION

Meeting: February 3 (Poinsett Hotel, Greenville, S. C.)

RHODE ISLAND SECTION

Meetings: January 26 (Providence Engineering Society), February 23 (Johnson's Grill), March 23 (Providence Engineering Society), April 27 (Wannamoisett Country Club), May 25 (Johnson's Grill), October 26 (Providence Engineering Society), November 16 (Johnson's Grill).

Outing: June 1 (Wannamoisett Country Club)

SOUTH CENTRAL SECTION

Meetings: February 10, May 12, December 1 (all in Hotel Patten). Summer Outing: August 24-25.

SOUTHEASTERN SECTION

February 24 (Talladega, Ala.), May 5 (Atlanta, Ga.), June 15-16 (Annual Outing), September 8 (Columbus, Ga.), December 8 (La Grange, Ga.).

WESTERN NEW ENGLAND SECTION

Meetings: Jan. 26 (Shelton), March 16 (Danbury), May 4, June 22 (Outing).

OTHER EVENTS

AMERICAN ASSOCIATION OF TEXTILE TECHNOLOGISTS

Meetings: February 28 (Hotel Commodore, New York); April 4, May 2, June 6, September 12, October 3, November 7, December 5 (Builders Club, New York).

AMERICAN SOCIETY FOR TESTING MATERIALS

Spring Meeting and Committee Week, March 5-9, Cincinnati, Ohio.

Annual Meeting, June 18-22, Atlantic City, N. J.

Spring Meeting and Committee Week, March 3-7, Cleveland, Ohio.

Annual Meeting, June 23-27, 1952, New York, N. Y. (The biennial Apparatus and Photographic Exhibits will be held in conjunction with this meeting).

NATIONAL ASSOCIATION OF TEXTILE MACHINERY MANUFACTURERS

Exhibit of American Textile Machinery, April 26-May 1, 1954, Atlantic City Exhibition Hall, Atlantic City, N. J.

TEXTILE RESEARCH INSTITUTE

Annual Meeting, Nov. 8-9.

ABSTRACTS

Recent Developments in Hosiery Dyeing and Finishing

E R Trotman, *Textile Recorder* 68, 128-30, September; 91-2, October, 1950.

Those who are engaged in the dyeing and finishing of knitwear have many special problems. The overriding necessity to retain the open structure and elasticity of knitted garments imposes a severe limitation on dyeing time. The need for clear bright shades combined with a high degree of fastness to washing and light demands the use of dyes which, in many cases, are not easy to apply. The problem of the selection of suitable dyestuffs becomes really involved when it is necessary to dye wool goods which have received an unshrinkable treatment, or wool and nylon mixtures. The hosiery dyer, therefore, welcomes all assistance in the form of better machines, new dyes and chemical assistants and refinements in process controls.

The author first discusses the problem of producing level shades on skein yarn without excessive entanglement, and compares the Hussong dyeing machine, which has been used for many years, with three new machines, the "Pulsator" (made by Samuel Pegg & Sons), and the "Ebflo" and "Plusflo" (both by Freeman Taylor Machine Co). Also described are the Pegg-Franklin cheese dyeing machine, and the "gridflow" (Freeman Taylor) hosiery machine, which is said to successfully dye nylon and fine gauge rayon or pure silk hose.

The author next discusses the progress that has been made in obtaining uniform penetration and distribution of the dyes throughout a batch of hosiery, partly by better design of dyeing machines and partly by the use of new chemicals (synthetic detergents, sequestering agents, etc). Optical bleaching agents, a new dyeing technique for applying the fast acid dyes to wool, and the Abbot-Cox process for dyeing packages with vat colors, are also described.—W.H.C.

High Polymers for Textile Fibers

R. L. Elliott, *Textile Recorder* 68, 85-7, October, 1950.

In this survey of the rayon and synthetic fibers the author describes the many types available and shows how their properties and suitability for various textile purposes can be largely deduced from a knowledge of their constitution.

The following fibers are discussed:

Cellulosic Rayons: Chardonnet, cuprammonium, viscose; the high-tenacity rayons Tenasco, Durafil and Fortisan; rayons modified by the incorporation of proteins to make them absorb wool dyes (e.g., Rayolanda); rayons made resistant to cotton dyes (and also to micro-organisms) by acetylation; and rayons made dimensionally stable by urea-formaldehyde.

Regenerated Protein Fibers: Lanital, Aralac and Fibrolane, made from casein, and others made from soya-bean, corn and peanut protein; all of which require hardening by means of formaldehyde cross-linking or metal-linking with aluminum and other salts.

Super Polyamides: nylon and the Perlons, made by combining a diamine and a di-carboxylic acid, possessing high tenacity, elasticity and resistance to chemicals.

Super-polyesters: Terylene (Fiber V), made by combining a di-carboxylic acid with a di-hydroxylic compound, which also has high tenacity.

Polymerized Ethylene: Polythene, lighter than water, and both chemically and water resistant.

Polyvinyl Fibers: Vinyon, Saran, Velon and Orlon, having high moisture resistance; Velon in particular is stated to be noninflammable.

Many of these new fibers have the serious disadvantage of poor dyeing properties, but the writer expresses the hope that the most recent dye technique, using molten metal, may solve this problem.—W.H.C.

Sizing of Rayon Staple Spun Yarns

F. G. LaPiana, *Textile Mercury and Argus* 123, 636, 639, October 20, 1950.

Rayon and other synthetic yarns spun from relatively short staples have a great amount of surface fibers. This condition results in lack of smoothness and evenness. If the surface fibers are not properly laid and made fast to the body of the thread they complicate the problem of weaving. They interfere with the proper opening of the shed through entanglement with adjacent threads. To break this entanglement and insure the formation of a clear shed it is necessary to weave the warps under comparatively high tension. As a result of chafing a considerable quantity of these protruding fibers is lost from the warp during weaving. Most of it accumulates on the under parts of the loom and on the floor under the warp, but some gets caught between the threads, balls up and interferes with their free passage through the banks of drop wires, harness and reed.

The main factor controlling the laying of the protruding fibers is the viscosity of the size solution. If the viscosity of the size is very low, not enough is left on the surface to form a coating of sufficient tack and continuity to hold the protruding fibers fast to the body of the thread. This condition does not exist in yarns of continuous filaments and this is the reason why sizes of low viscosity, almost water-thin, are suitable for continuous filament yarns which are smooth and have no fuzz, but very inadequate for staple spun yarns.

The author discusses the relative merits of various thickening agents used in warp sizing, and refers to tests run at the Textile School of North Carolina several years ago, under the sponsorship of the Textile Foundation and the Textile Research Institute, for the purpose of determining the relationship between the film properties of sizing materials and weaving efficiency.—W.H.C.

Properties of Starches and Dextrines

D. McGill, *Canadian Textile J.* 67, 74, 77-8, October 27, 1950.

Starches are derived mainly from corn, wheat, potatoes, tapioca roots, sago palm and to a lesser extent from rice, waxy maize and sweet potatoes.

These starches would be ideal for the majority of textile applications if it were not for the fact that their pastes, containing relatively small amounts of solids (ten per cent is about the limit under normal conditions) are extremely viscous. In order to extend or further adapt their uses they have to be modified during manufacture. The main aim of such modification is to reduce the viscosity of their pastes, thereby enabling higher concentrations to be used and additional take-up (on a dry weight basis) by the yarn or fabric. However, as is so often the case

in achieving these advantages, modification of starches impairs some of their most important properties—chiefly the film strength of their pastes.

The author discusses three important methods of modifying starches, namely: dextrinization, or heating the dry starch with or without acids, alkalis or other reagents; acid-modification, or treating the starch, suspended in lukewarm water, with sulfuric acid; and chlorination, or treatment of an aqueous suspension of starch with sodium hypochlorite.

The author states that the properties of starch which mainly concern the practical side of the textile industry are as follows: viscosity, film strength, flexibility, adhesion, solubility, gelation and foaming. All of these are discussed. Regarding viscosity, he states that there are at least ten recognized instruments for determining it, all of which, when operated under rigidly controlled techniques, are capable of yielding reasonably reproducible results, but each instrument, because it involves a different principle, gives a different result.

He points out that the starches are practically insoluble in water; the dextrines and acid-modified starches acquire solubility as their viscosity decreases. The more soluble they become, the darker the color. Also, the more highly modified the starches or dextrines, the less they will "gel".—W.H.C.

"Orlon" Acrylic Fiber: Chemistry and Properties

R C Houtz, *Textile Research J* 20, 786-801, November, 1950.

Orlon acrylic fibers are made from polymers containing large percentages of acrylonitrile. Their production has been made possible by the discovery of a number of unreactive organic solvents for such polymers. The solvents, which are of several chemical classes, are characterized by polar molecular groupings which apparently bond with and solvate the polymer molecules. The applicability of current theories of polymer solubility is discussed.

Polyacrylonitrile has been separated by precipitation methods into fractions which indicate normal molecular-weight distribution. A relationship between intrinsic viscosity and molecular weight is given. The polymer chains have a high degree of order in only one lateral direction. The structure appears to be almost completely that of a normal head-to-tail vinyl addition polymer.

Polyacrylonitrile fibers have remarkable resistance to heat, but gradually darken during treatments, going progressively to yellow, brown and black as heating is continued. A theory of the chemical changes involved is discussed. The contrasting behavior of polyacrylonitrile in solution, in which a stoichiometric random chain-scission reaction occurs in the presence of alkali, is described.

The Orlon fiber has approximately the same tenacity, elongation, elastic recovery and stretch resistance as natural silk. It has very low water absorption and moisture regain. Its resistance to weathering and to mineral acids is surprising. The fiber has remarkable dimensional stability and freedom from shrinkage in laundering. Also when blended with wool, Orlon has shown remarkable ability to stabilize the blend against shrinkage.

The problems which have been encountered in the dyeing of Orlon are the result of its "hydrophobic" nature. It can be dyed under special conditions with dispersed (Acetate) dyes and with certain thioindigoid vat dyes. Acid dyes stain it very lightly or not at all. Basic dyes can be applied, but show poor light fastness.

Twenty-one references to the literature are cited.—W.H.C.

Wool Research in the United States

G. E. Hopkins, *Canadian Textile J.* 67, 52-4, 56, November 10, 1950.

After reviewing briefly the work being conducted in various public and private research laboratories, the author reports that "we now have a three-pronged attack" directed toward better understanding of wool fiber characteristics and their relative significance.

First, the Wool Bureau is supporting a project at the Fabric Research Laboratories to collate, analyze and interpret the data now available in the literature. Wool and other apparel fabrics are included.

Second, the Research and Development Division of the U. S. Quartermaster Corps is making new tests on strength, stiffness modulus, immediate elasticity, primary and secondary creep for all textile fibers under varying loads and varying conditions of moisture, with each series carried out under identical test conditions.

Third, the Wool Research Project, being conducted at the Textile Research Institute and Forstmann Woolen Mills, includes a search for any differences in the chemical or physical structure of wools of the same fineness grown under widely different conditions. The significance of the physical and chemical structure and the measurable fiber characteristics on processing and performance of the product will be studied.

The author states that in order to apply our expanded knowledge of the wool fiber and its processing, we must have additional information on the performance of wool products and the comparative importance of the various product characteristics in its usefulness. The United States Army, with hundreds of thousands of men in a widely diversified group of activities, using garments and fabrics of standard design, provided under strict quality control, and with salvage departments available for examination of the worn fabrics, is "the perfect instrument" for obtaining this information.

The author closes with general remarks on the most desirable clothing to be worn under tropical and arctic conditions, and the advantages of wool over other fibers in absorbing perspiration.—W.H.C.

Rot- and Mildewproofing. The Search for Reliable Treatments.

Anon, *Textile Mercury & Argus* 123, 801-2, November 17, 1950.

Mildew proofing is defined as the protection of textile yarns and fabrics from growth of micro-organisms at the humidities and temperatures to be expected during transport to and storage in tropical climates. Prior to 1926 anhydrous zinc chloride was used in the proofing process with some success, but since then mildew antiseptics have been developed, one of the most important being salicylanilide or "Shirlan".

Among the properties required in a mildewproofing agent are these: it must be colorless, odorless, nonvolatile, and harmless to man.

Rot-proofing presents a somewhat more difficult problem, and is defined as protection from molds and bacteria of fabrics exposed out of doors to the sunlight and weather either with or without contact from soil or decaying vegetable matter. Hence rot-proofing must protect the fabric from both chemical and biological tendering.

A suitable rot-proofing treatment must prevent the growth of molds and bacteria, and should resist leaching during exposure to the weather, should not accelerate tendering during storage, and should leave the fabric porous to moisture vapor. Acetylation of cellulose is one possible solution but has only limited application. Precipitation of the oxides of iron and chromium on the fiber gives high protection against micro-organisms, when applied to cloth of low mildew capacity.

The author comments that all raw cotton contains appreciable quantities of potassium, sodium, calcium and magnesium, chemicals which are essential to

vigorous growth of molds producing the mildewing effect. Experimental work at the Shirley Institute showed that when the water-soluble constituents of the raw cotton are removed by complete scouring, then the molds are no longer able to thrive and the resistance of the fabric to micro-organisms increases considerably.

With a view to finding new and better methods of controlling the effect of bacterial action on cotton goods, the United States Army and Department of Agriculture recently announced that extensive tests are to be carried out over the next three years in order to guide the American Army in developing new fabrics with greater resistance to damage by micro-organisms.—W.H.C.

Dyeing of Wool-Nylon Unions

E V Burnthall, *Canadian Textile J* 67, 49-52, November 24, 1950.

The solution of union dyeing problems has always presented a fairly regular pattern wherein our past experience contributes in a very real sense to the satisfactory solution. Daily association with the fibers involved, and the development of an empiric science of control, made the choice of dyes and methods a relatively simple matter.

The production of satisfactory shades on wool-nylon mixtures should yield to similar methods of attack if it were not for our lack of knowledge of the controlling factors governing the dyeing of nylon and the rather confusing similarity between the dyeing behavior of the two fibers. Once we understand the peculiarities of nylon and the methods necessary to make the most use of them in our present problem, we can fit them in with our knowledge of wool dyeing and make real progress.

Nylon has a definite number of amino groups where dyes can unite with the fiber, and once these are filled, no further appreciable amounts of dye can be taken up. Approximately one-sixteenth as much dye can be absorbed by nylon as can be absorbed by wool under specific conditions. It is true that nylon has also imino groups which will combine with dyes at low pH values, but the affinity is too weak to be utilized.

Nylon absorbs most dyes more rapidly than wool under similar dyeing conditions; this is noticed especially in light shades. Certain metallized dyes, however, do not exhibit this tendency.

The author has much to say about the phenomenon known as "blocking", where one dye is preferentially absorbed by the fiber at the expense of another dye in the same bath, and shows how this affects the dyeing of combination shades on wool-nylon blends.

The pH of the dyebath plays an important part in the nylon dyeing process. This sensitivity of nylon to pH is reflected in wool-nylon dyeing where small pH variations produce very marked changes in the color balance between the two fibers, and is responsible for many of the puzzling results which are sometimes obtained with established formulas.

The author makes some practical suggestions for putting the unusual dyeing properties of nylon to good use in the dyeing of wool-nylon blends. He states that the choice of the proper dyes to produce a given shade can be simplified if one becomes familiar with a few dyes in each class and learns how to control their dyeing behavior. A good general rule is to dye light to medium shades with metallized dyes, medium and dark with milling dyes, and heavy shades with chrome dyes.

Recommendations are made of suitable dyes to use in all three groups, and for the control of the pH of the dyebath. The difficulty of dyeing chrome colors on nylon, because of incomplete reduction of the bichrome, is explained, and a remedy is suggested.—W.H.C.

Preparing Rayons for Resin Finishing

J M Schandler, *Canadian Textile J* 67, 62-3, November 24, 1950.

The advent of resins has opened an entirely new vista in the textile industry, making possible, for example, wash-proof finishes and crease-resistant fabrics. The author describes the processing of a roll of 50-50 spun viscose-acetate blended fabric through a plant, in preparation for a crease-resistant finish.

Prior to desizing, the goods should be adequately singed on both sides. Neglecting to do this may cause the fabric to dust excessively after finishing is completed. After singeing, the fabric is quenched in an enzyme solution, which contains a penetrant that does not reduce the effectiveness of the enzyme.

After squeezing, the goods may be handled in several ways. One conventional manner is to batch the fabric on rolls and stand them on end for two or more hours. Another method is to batch the goods open width in a box or truck. Still another method (with the proper type enzyme) is to have the quetsch or padder connected in tandem with an open width steam box. The fabric should be given at least 30 seconds in this chamber, after which the starch is converted.

There are two conventional types of boil-off machines, open width and rope form. Both methods have their advocates. The ingredients in the boil-off are extremely important. A surface-active agent must be used which will not form lime soaps in hard water, will remove solid soil, will emulsify oils, will remove greasy soils, and which will possess sufficient wetting ability to prevent the fabric from floating. In addition, an alkaline builder is normally used to maintain the pH at 9.5 to 10.5 to promote detergency.—W.H.C.

Orlon, Fiber V Dyeing Technique is Improved

P L Meunier, *Textile Age* 14, 32-4, December, 1950.

In the last year Du Pont dye research has made several important improvements in the technology of dyeing Orlon continuous filament fiber. The most important was the coloring of yarn, sewing thread and fiberstock in aqueous baths under pressure at high temperatures. At 250° F or above, the acetate colors yield fairly heavy shades such as OD No 7 and Shoe Brown. Selected vat colors of the thioindigoid class produce a full range of shades.

Soluble vat colors may be applied to fabrics of Orlon continuous filament by padding the fabric with a solution containing color and sodium nitrite, followed by a short oxidation with hydroxyacetic acid in a jig at 200° F. With equal success, insoluble vat colors in the form of vat acids have been applied on fabrics made from Orlon, as well as on yarns and fiberstock.

Orlon acrylic staple, which is still under development, has markedly improved dyeing properties which make it suitable for wide textile uses. The staple exhibits its best dyeing behavior in the range of 200 to 212° F, and therefore is readily dyed in existing mill equipment.

Fiber V, in regard to dye absorption, is rated between nylon and Orlon continuous filament. It exhibits its greatest affinity for dispersed acetate dyes. Vat colors and certain "Naphthanil" combinations dye this fiber under pressure at high temperatures. Many types of colors are also applicable by the Thermosol dyeing process. None of the water-soluble dyes, including acid, chrome, and direct colors, have affinity for the fiber.

Basically, there are three methods of dyeing Fiber V: aqueous dyeing at temperatures near the boil, aqueous pressure dyeing at temperatures above 212° F, and Thermosol dyeing which involves heat treatment. All these methods depend on the swelling by water or steam at high temperatures, "carriers", or dry heat.—W.H.C.

• PATENT DIGEST •

PAUL WENGRAF

SHRINKPROOFING AND MOTHPROOFING—Alkylated Methylolmelamines Plus Melamine Fluosilicate A, 2, 04

U. S. Pat. 2,514,132
(American Cyanamid—Kienle, Amick—July 4, 1950)

This specification states that shrinkproofing woolen material (either from pure wool or mixed wool-cellulose) with alkylated water-soluble methylolmelamines is well known by itself. Re-issue patent No. 22,566 (Johnson, et al.) is quoted as a specific example. On the other hand, many publications, referring to mothproofing animal fibers by silicofluorides (e.g., the triethanolamine salts) are cited. The present invention aims at combining these two effects by mixing water soluble alkylated methylolmelamines, especially those prepared by acid catalyzed condensation and immediately neutralized before insolubilization occurs, with melamine fluosilicate or fluoborate. The proportions of both components are important: one p. of the alkylated methylolmelamine should be blended with 0.05-1 p. (preferably with 0.05-0.5 p.) of the melamine fluosilicate or fluoborate. The aqueous mixture of both components is well stirred; it can be diluted with water to a total solid content from 4-5 to 30-35% of the finishing solution. Other auxiliaries or buffering substances or surface active agents are optionally added as well as some curing catalysts, but the fluorine containing anion acts as a catalyst by itself. The pick-up of the finish is limited with 40-150%, the solid content of the dried goods with 2-25%. It might be indicated as a general rule that a large excess of the melamine resin over the fluosilicate impairs the mothproofing qualities while, on the other hand, the stability of the effect is decreased by a substantial excess of the fluosilicate.

It was unexpectedly found that the resin, insolubilized by subsequent curing, did not mask the mothproofing property of the melamine fluosilicate or that this salt did not reduce the shrinkproofing effect. Surprisingly, both components were found to coact and to improve the results. Several examples describe details of the finishing operation which consists of mild drying (185°F.) of the impregnated goods, followed by curing at about 300°F. for 10 minutes. Tests carried out according to standard methods proved the durability of the shrink resistance as well as the fastness to the attack of moth and carpet beetles.

References cited by the Patent Office, among others:

U. S. Pat. 2,388,143 (1945—Cyanamid): preparing hardenable resins, useful as adhesives from melamine formaldehyde condensates using fluoborates or fluosilicates as catalysts.

U. S. Pat. 2,368,451 (1945—General Electric): condensing a monosalt of a polyaminotriazine (melamine) monochloride with a melamine formaldehyde resin while heating to obtain resinous coating compounds or adhesives.

U. S. Pat. 2,318,121 (1943—Ciba): a melamine-aldehyde composition, used in laminating plywood or in brush manufacture comprises a melamine formaldehyde precondensate, starch and an ammonium salt of a strong acid such as sulfuric acid. (This reference is quoted in the present specification).

U. S. Pat. 2,267,871 (1941—Geigy): substituting solubilized compounds of the triazine class with aromatic amines to prepare wool mothproofing agents.

CELLULOSE ACETATE PRINTING—with Methylcellulose Thickener and Strongly Alcoholic Solutions C, 2, 07

U. S. Pat. 2,514,410-11
(Celanese Corp. of America—Olpin, Law—July 11, 1950
(Celanese Corp. of America—Olpin, Jackson—July 11, 1950

Fabrics of cellulose acetate can be printed with dyes which have practically no affinity for this fiber by the use of highly concentrated alcohols as solvents. Dyeing with diluted alcoholic solutions has repeatedly been discussed (see REPORTER 1948, 397 and other references noted below). Difficulties have been experienced in thickening these alcoholic solutions with standard thickeners. It has been observed, however, that solutions of an alcoholic content of 60-70 and up to 75% can well be made into a printing paste by using water soluble, highly viscous methyl cellulose solutions. Details of this composition will be reported in digest to U. S. Pat. 2,514,411.

Printing mordant, acid or other water soluble dyes has the advantage of a great choice of shades of high fastness to light and particularly to coal gas fumes. Examples of Chrome dyes are, among others, Chromocitronine R, Omega Chrome Brilliant Blue B 200 and Chromazurine G; for direct dyes, Chlorantine Fast Orange T G L L; for acid dyes, Solway Green GS and so on.

The following (U. S. Pat. 2,514,411) refers to printing of oxygen developed bases of the aniline black type, according to an analogous method as described in the precedent patent. The organic base (aniline, p-phenylene diamine, etc.) is dissolved in dilute alcohol of 55-75% strength and thickened with methylcellulose of a methoxyl content of 26-27%. A 2% solution of this product has a viscosity of 350-500 centipoises at 25°C. This thickener is a very viscous liquid; about 1-2% (of the dilute alcohol solution of this base) gives a paste of satisfactory consistency. Other ingredients generally used in printing aniline black (oxydizing agents such as chlorate, catalysts, e.g., potassium ferrocyanide, and ammonium thiocyanate as a softening agent for acetate rayon) are added. In a similar way Indicosol dyes can be fixed on the fiber. One of the examples cites a printing paste mixed (a) from aniline salt, formic acid, ammonium thiocyanate and about 56% methanol and 2.2% methylcellulose and (b) a solution of sodium chlorate and cupric chloride. The printed goods are steamed and developed in acid chromate solution.

References cited by the Patent Office, among others:

To U. S. Pat. 2,514,410:

U. S. Pat. 2,428,836 (1947—Celanese): printing with acid dyes on acetate rayon with a paste containing acetic acid, ethanol and thiocyanate; fixing by drying and washing (see REPORTER 1948, 397).

U. S. Pat. 2,384,001 (1945—Celanese): adding swelling agents and solvents to a cellulose acetate dyebath, e.g., acetone and denatured alcohol or mixtures of aliphatic esters to solvents.

U. S. Pat. 2,365,809 (1944—Celanese): dyeing cellulose acetate with mordant dyes from an aqueous-organic solvent containing the dye and the mordant, volatilizing the solvent and steaming.

U. S. Pat. 2,344,973-74 (1944—Celanese): a dyebath for cellulose acetate of cellulose contains at least 70% of a lower alcohol such as ethanol, methanol or propanol. Optionally, the fibers thus dyed can be topped with the same dyestuff in aqueous solution.

To U. S. Pat. 2,514,411:

U. S. Pat. 2,428,835 (1947—Celanese):

dyeing acetate cellulose with acetate or acid dyes from a 60% alcoholic bath using a thiocyanate as a swelling agent (see REPORTER 1948, 397).

U. S. Pat. 2,428,836. See the foregoing digest.

U. S. Pat. 2,248,048 (1941—Celanese): printing composition for cellulose acetate, comprising a solvent such as diacetone alcohol and a water soluble cellulose ether such as carboxy alkyl cellulose as a thickener.

U. S. Pat. 2,196,270 (1941—Celanese): obtaining aniline black or other similar oxydation colors on cellulose acetate by warming with aniline, some aniline salt and oxydizing agents; developing oxygen when heated + a water miscible organic solvent.

Reference is further made to an older Brit. P. 387,343 of the same company, proposing the use of a methyl cellulose thickener (Colloresin) for printing various dyestuffs on cellulose acetate. Aniline black has not been mentioned in this reference.

RELIEF PRINTING MACHINE —Printing Plates, Moved Against the Fabric's Surface D, 4

Brit. P. 640,103
(Forshaw—July 12, 1950)

The device described in the present invention comprises belt carriers (11 and 12)—see Fig. 1—provided with pins (13). The fabric to be printed is fed from (17) over a tension roller (18) and a roller (19), fitted with three rows of pins (20), projecting radially from the edge portions to impart tension across the width of the fabric. Thus the goods are under tension in both dimensions during the printing operation which is carried out by printing plates (24) (25) and (26), fixed on a rigid table (27). The plates have previously been furnished with printing inks of different colors. The plates are placed about 0.1" below the lower surface of the fabric (14). Printing itself is effected by pressing down the fabric (14) by means of a hard rubber roll. The printing paste is merely described as "letter press ink of laundry quality", i.e., laundry resistant colors. The device is principally intended for printing silk squares; the printing blocks may be made of zinc or wood.

Reference is made to Ger. Pat. 652,297 (1934—Wurm): a screen printing machine for fine silk fabric is adapted to transport the fabric, which is fixed by pins to a carrier belt, by intermittent movement over a printing table. The present invention differs from this device in that printing is carried out by means of relief blocks placed below the fabric to be printed.

PIGMENT DYEING—Alkylcelluloses and Hydoxy Alkyl Celluloses Used C, 1

U. S. Pat. 2,515,170
(Interchemical Corp.—Cassel, Clifford—July 18, 1950)

Pigment pad dyeing from aqueous dispersions is effected, according to the present invention, by using heat precipitable alkylcelluloses, combined with thermosetting resins and with nonprecipitable hydrophilic glucosides. The preamble of this specification points to a copending application (apparently not yet in a patent) which describes a pigment pad dyeing liquid containing a heat precipitable alkyl cellulose and a thermosetting resin. The alkyl cellulose has the effect of preventing migration and flocculation of the pigment in the padding process. The present modification of this method indicates certain difficulties, also experienced in the first mentioned method. Considerable amounts of the cellulose ether, which prevents speedy drying on customary cans, have to be incorporated in the liquid. Moreover, severe curing conditions (temperatures up to 400°F. have to be used for insolubilizing the thermosetting component. These drawbacks can be avoided by further incorporating hydrophilic glucosides, which can either be water soluble, nonhardenable hydroxy alkyl cellulose ethers (generally obtained by reacting ethylene chlorohydrine with alkalicellulose), Carboxymethylcellulose or mannogalactan flour. The last named is exemplified by vegetable gums (guar flour, a foreign leguminaceae product, locust bean gum or the like). It has been observed that in this case the quantity of the heat coagulating alkyl cellulose can substantially be reduced, that the migration and flocculation of the pigment is better under control and that finally, lower temperatures are sufficient for curing the thermosetting resin part. The fabric is fast enough to washing to be printed afterwards with vat or azo colors. It has a natural crisp hand without requiring an additional starch finish. One of the examples cites the following proportions:

3% solution of a nonprecipitable cellulose ether	50%
5% solution of a precipitable methylcellulose	1.6%
water	47.2%
50% solution of a glycol modified, water soluble, melamine-formaldehyde solution	0.8%
25% aqueous pigment dispersion	0.4%
	100%

Examples of pigments used are: iron oxide red, the vat color C.I. 1113 (Ponsol Blue GD or Indanthrene Blue GCD), Copper Phthalocyanine Green, insoluble azo pigments and Carbon Black. All of them are in water-extensible dispersion, for instance, as press cakes.

References cited by the Patent Office, among others:

U. S. Pat. 2,378,322 (1945—Dow Chemical): porous insulating material such as cork or Vermiculite treated with a water soluble cellulose ether and a precondensate of a thermosetting resin.

U. S. Pat. 2,370,517 (1945—Dow Chem): Insolubilizing cellulose ethers by adding formaldehyde-melamine condensates in the presence of acids.

U. S. Pat. 2,336,484 (1943—Maas & Waldstein Co.): a pigment printing process using lacquer-in-water emulsions containing, in the lacquer phase, solvent-soluble urea-formaldehyde and in the aqueous phase, Bentonite, a pigment (Benzidine Yellow) and resin solutions as dispersants.

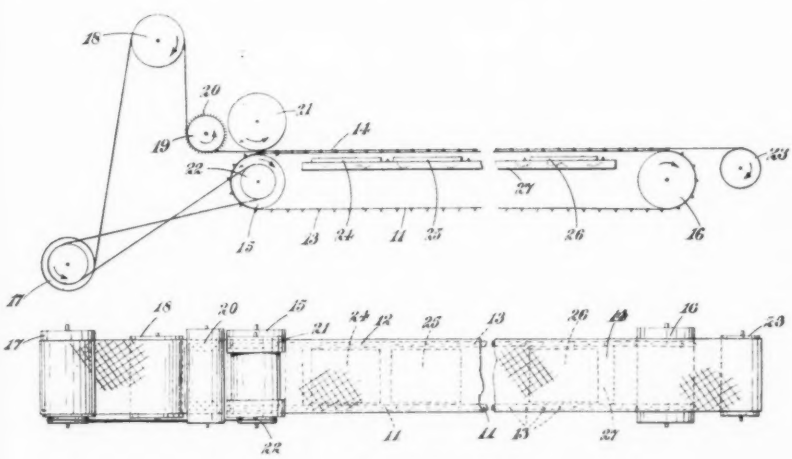


Figure 1—British P. 640,103
Above—Schematic of Side of Relief Printing Machine
Below—Schematic of Top of Same Machine

U. S. Pat. 2,275,991 (1942—Rohm & Haas): a textile printing paste composed of methyl cellulose thickener or another water soluble thickening agent, a colored pigment and a resin, deposited from an aqueous dispersion as an insoluble film.

U. S. Pat. 2,270,180 (1942—Dow Chem.): water soluble cellulose ethers insolubilized with a glycol modified urea-formaldehyde condensate which is cured thereupon.

This process discloses an innovation over former published pigment pad-dyeing methods in that the typical oil-in-water emulsions (e.g., U. S. Pat. 2,488,544, REPORTER 1950, 99) are no longer used. The pigments are kept in stable dispersions by exclusively using water soluble cellulose derivatives.

PRINTING TEXTILES—Photographic Production of Patterns D, 1

Brit. P. 640,308
(J. Holden—July 19, 1950)

The technique of printing textiles by impregnating cloth with light sensitive substance and exposing selected areas to light, thus using normal photographic methods for decorating cloth, is improved by the present invention. The cloth to be sensitized is first stiffened so that it can be held flat during the exposure. The sensitizing compound has to be applied in a solution incapable of dissolving the size so that the fabric is maintained in a rigid state throughout the entire operation. Thereafter the size has to be removed. Appropriate sizes contain starch, glue or methylcellulose. The fabric must not be substantially filled but slightly reinforced to acquire just paper-like stiffness. The preferred sensitizing substance is a light-sensitive diazo compound which loses the ability of coupling with one of the usual coupling components when exposed to light. The diazo compound consists e.g., of diazo benzylethylaniline dissolved in methanol or acetone + tartaric acid. The stiffened and impregnated cloth is then exposed, under a patterned negative, to actinic rays and passed thereupon through the coupling composition, e.g., phloroglucinol dissolved in sodium carbonate. Barium salts are optionally added to this bath to prevent bleeding. The nonexposed portions are dyed to form the photographic image. According to another example, the sensitizing agent comprises a nonaqueous solution of a ready made diazo compound plus a coupling component; this composition does not form the azodye under acid or neutral conditions. The image is developed in an alkaline medium (e.g., ammonia vapors). In this event wetting of the fabric is completely avoided and thereby a new image of different design and shade can be superimposed over the first while the material is kept in stiffened condition.

Printing textiles by photographic means has been discussed in Swiss Patent 251,099 (Seligmann—1948, REPORTER 1949, 476). Some references to these methods can also be found in this digest.

DYEING WITH ACID—Absorption and Diffusion in Two Separate Steps C, 4, 06

Brit. P. 640,419
(Wolsey Ltd.—Alexander, Charman—July 19, 1950)

This invention refers especially to a dyeing method with surface active dyes, exemplified by the "Carbolan" dyes, manufactured by Imperial Chemical Industries. The dyeing process is characterized by a surface absorption of the dye, followed later (mostly under the influence of elevated temperatures in a prolongated treatment) by diffusion into the fiber's body. The adsorption of the dye solution is rapid even at temperatures as low as 50°C., but the dye is not yet fixed and can be almost completely rinsed off with cold water. This condition can be changed by adding, as a second step, an aftertreatment with water vapor or steam above 40°C. and preferably at 90-140°C. The great advantage of dyeing at room temperature is in that dyes which normally give no level results (such as the "Carbolan" dyes) dye uniformly; thus the process can be carried out continuously while the material is not left for a considerable time in hot acid liquids, which might reduce the material's wearing qualities. The dyebath itself may contain some electrolytes (e.g., ammonium acetate), but it has been observed that absorption is not substantially increased by an excess of these substances.

It should be emphasized that the process refers mainly to dyes having surface active properties by themselves. It does not apply to easy leveling color types (e.g., acid dyes like Orange II, Azogeranine B 200, etc.), which do not lower the surface tension, while the Carbolan dyes distinctly show this effect. As an example, a woolen knitted fabric was immersed during stirring for 3 min. at 50°C. in a bath of 0.5 gm./liter of Carbolan Crimson BS containing up to 2 gm. ammonium acetate per lit., removed, squeezed and dried in an oven at 80°C. This dyeing appeared in the same full shade as goods dyed according to conventional methods at the boil. Although the method is particularly described for processing wool, other fibers having affinity for acid dyes, such as animalized cellulose fibers or nylon (see p. 3 lines 84-85 of the patent) may be dyed the same way.

Reference is made to several publications which generally suggest better penetration and fixation by a steam aftertreatment.

U. S. Pat. 2,474,890 (Celanese—1949): steam aftertreatment of nylon dyed with acid dyes (see REPORTER 1949, 756).

U. S. Pat. 2,080,254 (Celanese—1937): applying dyes of little affinity (vat dyes) to cellulose acetate and promoting penetration by subsequent heating.

Brit. P. 470,333 (Celanese): applying organic solutions of acetate dyes, followed by a steam aftertreatment.

While these and some other processes have been recommended for various fibers, this idea has apparently not been used for dyeing wool fibers at low temperatures, whereby the advantage of preserving the original fiber's character can be attained.

"Carbolan" dyes are a new series of neutral dyeing acid dyestuffs of high fastness to water and light, obviously non-leveling, fulling dyes. Two brands of this series, Carbolan Brilliant Blue 2 RS and Carbolan Fawn RS, have been described in *J. Soc. Dyers & Colourists* 1947, 154.

DYEING CELLULOSE ACETATE WITH ACID DYES—Phenols Added C, 4, 07

Brit. P. 640,458
(American Viscose Corp.—July 19, 1950)

Two general methods for dyeing cellulose acetate with acid dyes are known: (a) the alcoholic assistant method, using relatively high concentrations of low water miscible alcohols as solvents—(e.g., see U. S. Pat. 2,428,833-36, REPORTER 1948, 397) and (b) the acid assistant method, applying mixtures of organic and inorganic acids in aqueous dyebaths. Method (a) gives dyeings of superior fastness in a rapid process while (b) is more economical. In both cases, high concentrations of these assistants have to be used. The amounts of alcohols or acids can be substantially reduced according to the present method. This invention suggests adding small amounts of hydroxy-derivatives of benzene or polyhydroxybenzene (e.g., resorcinol, phloroglucinol or cyclohexanol). These substances are termed as auxiliary assistants. They have the effect of giving adequate results in the dyeing process, and considerably less quantities of the lower alcohols or acids are needed.

According to one example, a cellulose acetate fabric was dyed with Brilliant Wool Blue BL (C.I. 833) in the presence of 30% ethanol and 3% resorcinol, and exhibited the same shade and fastness as a similar sample dyed in a 75% ethanol—25% water dyeing liquid. Another exam-

ple mentions dyeing with Anthralan Red BA in a bath containing 1% resorcinol and 2.2% sulfuric acid at 175°F. The sample was dyed the same shade as a specimen dyed with a mixture of 8 1/3% acetic acid, 8 1/3% formic acid + 8 1/3% sulfuric acid by weight when resorcinol was omitted.

The phenomenon is not fully explained but it might be assumed that the fibrous material undergoes some change by the influence of the hydroxy aromatic compounds. An excess of these auxiliaries causes elongation of the fiber's structure; in omitting these agents, contraction and delustering result in an analogous treatment.

Reference is made to U. S. Pat. 2,112,-275 (Dreyfus) suggesting the addition of resorcinol, phloroglucinol, etc., to saponifying baths for cellulose acetate to counteract the destructive action of alkalis. This process, however, does not refer to acid or alcoholic dyeing operations.

DYEING WOOL——Azodyes with Chrome Complex, Aldehyde Aftertreatment G, 4, 06

U. S. Pat. 2,516,496
(Ciba—Widmer, Buehler—July 25, 1950)

This specification refers to U. S. Pat. 2,422,586 of Cyanamid (see references) protecting a dyeing method which uses metalliferous azodyes of the Neolan type in the presence of aldehydes to gain the effect of inhibiting premature lake formation of the dye. It is stated in the present patent that, in this case, excess formaldehyde has to be present during the entire dyeing operation, which is carried out for a relatively long time at elevated temperatures. Loss of formaldehyde and the inconvenience of bad odor are therefor unavoidable. The invention aims at improving these conditions by dyeing first in the absence of aldehyde and then aftertreating with aldehyde in a second bath. The effect is said to be equal to that obtained in the aforementioned procedure. This phenomenon is not quite understood but it might be assumed that certain decomposition products, which are formed by demetallization and therefor dull the shade of the dyed material, are decomposed in this process and stripped by the aldehyde while the metal complex proper is not affected. One of the examples cites a dyeing with 1.5% of a chromium complex of an azocolor, 8% sulfuric acid and 10% Glauber's salt as usual, as well as the addition to the exhausted bath of 5% of a 40% formaldehyde solution. This second treatment is carried out within 15 minutes to one hour. Other examples mention benzaldehyde sulfuric acid instead of formaldehyde.

References cited by the Patent Office, among others:

U. S. Pat. 2,422,586 (Cyanamid—1947): dyeing nitrogenous fibers, particularly wool, with metal complex azodyes in the presence of a compound which develops aldehydes up to C_6 during the dyeing process (cf. REPORTER 1947, 665).

U. S. Pat. 2,263,894 (Du Pont—1941): aftertreating tetrakis-azo dyes in a second bath with formaldehyde to obtain washfast shades. This process is applied to cotton and regenerated cellulose. Metallizing azo dyes is mentioned too, but the specification obviously does not refer to dyeing keratinous fibers.

DYEING CELLULOSE ACETATE——Vat Dyes in Alcoholic Reducing Liquids C, 4, 07

U. S. Pat. 2,518,153
(Du Pont—Laughlin—Faulk—Aug. 8, 1950)

Dyeing cellulose acetate with vats is known to cause saponification in prolongated treatments and it is desirable to dye this material with the fastest dyes of the vat group without impairing the original character of the acetate fiber. The problem, it is claimed, is solved by preparing an alkaline hydrosulfite vat, containing a substantial amount of alcohol, and to add a wetting agent and a glycol (diethylene glycol, thiodiethylene glycol or glycerine), termed a *vat stabilizing agent*. Speedy penetration of the dye liquid may be observed here. The alkalinity of the dyebath has to be lowered quickly to a point where no attack on the cellulose ester occurs.

Alcohols used are ethanol or propanol; their concentration in the bath varies between 30-60%. Any of the standard wetting agents can be employed but it is necessary to add the "stabilizer" to maintain the leucovat in a well dispersed state.

A great part of the usual dispersants are not efficient in alcoholic solution; the polyalcohols, mentioned above were found to be most appropriate.

According to several examples, Ponsol Golden Orange paste (C.I. 1098) is made into a vat with KOH and hydrosulfite in the presence of wetting agents and diethylene glycol, padded at 140°F. (the upper limit is 150°F., where saponification starts), squeezed to a 56% pick-up and then passed for a short time through a soda ash-alkaline hydrosulfite bath (described in Du Pont's U. S. Pat. 2,318,133 as a developing passage before reoxidizing the vat) to lower the pH of the solution.

Reoxidation is effected with dichromate-acetic acid and a very fast orange dyed fabric results. It should be mentioned that this fabric remains unstained after an immersion in a direct blue, thus proving that no saponification takes place.

References cited by the Patent Office, among others:

U. S. Pat. 2,090,511 (Calco Chem. Div. —1937): obtaining self dispersing vat dye preparations by mixing the dye in the form of a thin paste with a deflocculating agent (dextrine), protective agents (sulfite waste liquor) and wetting agents (isopropyl naphthalenesulfonate = Nekal). The object is to readily obtain complete dispersions in printing pastes.

U. S. Pat. 2,067,926 (National Aniline—1937): soluble alkali salts of acidic lower alkylsulfates, e.g., n-or secondary butyl sulfate, mixed with a suspension of a vat dye to give homogenous suspensions.

Brit. P. 583,349 (Celanese—1946) dyeing cellulose acetate with a solution of the dye in dilute lower alcohol + thiocyanate as a swelling agent. (This patent probably corresponds to U. S. Pat. 2,428,-835, (cf. REPORTER 1948, 397).

French Patent 847,107 (Rivat—1939): dyeing cellulose acetate with vat dyes dispersed in a solution of a swelling agent (acetone) plus the necessary reducing agents (at relatively low temperatures) and re-oxidizing with peroxide.

Reference is further made to Brit. P. 462,222 (Celanese) referring to the dyeing of cellulose acetate with Indigosol dyes (and thus, stabilized and reduced vats) in concentrated organic solvents boiling below 130°C. Development is effected as usual.

DYEING CELLULOSE ACETATE—Aqueous Dispersions of Organic Acids, Combined with Swelling Agents C, 4, 07

U. S. Pat. 2,518,644
(Celanese Corp. of America—Seymour, Ward—Aug. 15, 1950)

Dyeing cellulose acetate with acid or direct dyestuffs from dilute alcoholic solutions has frequently been described (references will be cited below). These alcoholic solutions contain to a lesser extent (e.g., from 1-8%) a lower aliphatic acid (cf. U. S. Pat. 2,428,834-835, mentioned in the references). The present patent differs from this group of dyeing methods in that aqueous dispersions of various dyestuff groups containing relatively high percentages of lower aliphatic acids plus an inorganic swelling agent are used with the same effect. It should be emphasized that the impregnation may be effected (in this case) within a few seconds, thus making continuous dyeing possible. The dyed material can immediately be rinsed or scoured without intermediate drying or otherwise extending the time of contact of the fiber with the dyestuff solution. Use of

acetic, propionic or butyric acids in concentrations of 25-35% of the weight of the dyebath are suggested. Inorganic swelling agents are ammonium-, potassium- (and preferably) sodium thiocyanate, applied in concentrations of 3-10% (generally 2-3%). The dyebath temperature is about 25°C.; impregnation time varies between 1-15 seconds. Various groups of dyes are said to give satisfactory results, e.g., acid, direct, even water soluble; also, typical acetate dyes. The examples cite the use of Artol Blue GL (C.I. 833, identical with Wool Fast Blue GL, an acid dyestuff), Amanil Chrysophenin G ex conc. (C.I. 365, identical with Chrysophenin G, a direct dye) or Vitrolan colors; thus, premetallized chrome dyestuffs of the Neolan type. The dyeings are said to be of excellent fastness to light, washing and gas fading.

References cited by the Patent Office, among others:

U. S. Pat. 2,428,834-835: direct dyeings, obtained by dissolving in highly concentrated alcohols (60% and more) plus 1-8% of a lower aliphatic acid; also, applying acetate dyes + dil. alcohol mixed with thiocyanates (cf. REPORTER 1948, 397).

U. S. Pat. 2,380,503 (Celanese—1945): dyeing with an organic solution of an acetate dyestuff in a lower ketone, rapidly drying and topping with the same dye in aqueous dispersion.

U. S. Pat. 2,365,809 (Celanese—1944): dissolving appropriate mordants and mordant dyes in an organic solvent (methanol) and steaming.

U. S. Pat. 2,347,001 (Schnegg—1944): animalizing triacetate (the chloroform soluble ester fiber), treated with acetic acid as a swelling agent, and aftertreating with a Peregal type agent. Dyeing is done with acid dyes.

U. S. Pat. 2,344,973 (Celanese—1944): dyeing cellulose acetate with acetate dyes, such as Cellitone Fast Blue or SRA dyes, by dissolving in 70% alcohol, impregnating and rapidly drying.

Reference is further made to Brit. P. 589,245 (Textron, Inc.): using inorganic or organic acids (e.g., 16% formic acid) together with a minor proportion of a solvent (e.g., Cellosolve) to dye acetate of cellulose with mixtures of acid dyes such as Wool Fast Blue GL combined with Alizarine Cyanine Green GHA (cf. REPORTER 1948, 243).

DYEING CELLULOSE ACETATE with Indigosols—Urea Added C, 4, 07

Brit. P. 641,835

(Brit. Celanese—Olpin, Jackson—Aug. 23, 1950).

Earlier patents of Celanese Corp. suggest the dyeing of cellulose ester fibers with various dyestuff groups, dissolved in mixtures of water and organic liquids. One of these patents (U. S. Pat. 2,428,833, cf. AM. DYESTUFF REPTR. 1948, 397) protects the process of application of sulfuric acid esters of leucovat dyes (Indigosols, Algosols, etc.) from solutions of this type followed by reoxidation to the parent vat dye. The present specification mentions Brit. P. 462,222 and 583,349*. These refer to an analogous process.

It has now been observed that this method can be substantially improved by adding urea to the dyestuff solution and following with a steaming operation. Organic water-miscible solvents, used in this process at an amount of 60-70% are lower alcohols, glycols or acetone. 10-15% urea, which can optionally be replaced by formamide, acetamide, urethan, etc., gives good results. An example states that the padding liquid consists of 67.5 ml methanol, 22.5 ml water, 10 gm urea, 2 gms Indigosol Golden Yellow I R K and 2 gms ammonium thiocyanate. The dye is dissolved in the alcoholic solution which then has to be cooled down. Padding is effected at room temperature (23° C); the fabrics are steamed twice for 20 minutes at 107° C., oxidized in nitrite sulfuric acid, rinsed, soaped, rinsed and dried. An analogous printing formula is offered in another example.

An interesting special effect obtained in this process is caused by the different dyeing behavior in applying these solutions to mixed fabrics of acetate and regenerated cellulose. It was found that the steamed (but not yet oxidized) solution is readily absorbed by the cellulose acetate-portion while it can still be removed in this phase from the cellulosic fibers by washing. Thus a fabric of the mixed type, steamed and thoroughly washed, can be cross-dyed with direct dyes; thereupon, it is oxydized to give two-tone effects consisting of direct dyed rayon fibers and vat dyed acetate fibers.

Further reference is made to an earlier Celanese patent (U. S. Pat. 1,972,111) describing an improvement of dyestuff fixation and light fastness by an impregnation with thiourea, followed by steaming. This patent, however, does not refer to Indigosol dyeing methods.

* According to the application data, these are similar, but not quite parallel to U. S. Pat. 2,428,833.

STABILIZING CELLULOSE TEXTILES——(Shrinkproofing)—Glyoxal plus Magnesium—Silicofluoride G, 2, 04

U. S. Pat. 2,521,328

(Alrose Chemical Co.—Beer—Sept. 5, 1950)

This patent is a continuation- in-part of the same inventor's U. S. Pat. 2,484,545 (see below) describing stabilizing cellulosic fibers with glyoxal plus a salt of an oxygen yielding acid. Quite generally it has been observed that a treatment with glyoxal and oxalic acid as a catalyst severely reduced the tensile strength of the fibers in a subsequent curing process. Modifying salts which counteract this tendering action of glyoxal have to be applied. According to the present invention, certain inorganic salts of silicofluoric acid are suggested. While, for example, the presence of oxalic acid increases the acidity, an inverse effect is attained by applying magnesium silicofluoride which decomposes during the baking step to yield a nonbasic decomposition product according to the equation:

$$Mg\ Si\ F_6 \rightarrow MgF_2 + SiF_4$$

Silicofluoride, acting as the catalyst, volatilizes while the alkaline magnesiumfluoride, directly formed on the fiber, buffers the reaction. Any other silicofluoride could likewise be used as a catalyst; the alkali- or ammonium salts, however, are insufficiently soluble. Zinc-, magnesium- or cadmium salts are sufficiently soluble and obviously the magnesium salt is preferred by reason of the lower costs. Other metal salts (Ni, Co, Fe Mn or Hg) are also quite soluble, but their application is limited because they form colored compounds. They may be used when the darker shade is not objectionable for combining mildewproofing, water repellent or flameproofing effects with the stabilizing finish. A formula for a shrinkproofing solution, applied on a 100% spun rayon fabric, comprises 70 gm. glycol 30%, 15-20 gm. $MgSiF_6 . H_2O$ in one lit. water (the salt has to be dissolved at 38°C.); the goods were dried at moderate temperature and cured above 100°C.

References cited by the Patent Office, among others:

U. S. Pat. 2,436,076 (Cluett Peabody—1948): stabilizing a cellulosic material (preferably regenerated cellulose) with glyoxal in acid solutions (cf. REPORTER 1948, 475).

U. S. Pat. 2,412,832 (Cluett Peabody—1946): stabilizing with glyoxalaminoformaldehyde in acidic condition (REPORTER 1947, 337).

U. S. Pat. 2,233,402 (North American Rayon—1941): crushproofing cellulose with formaldehyde plus an α—halogenated fatty acid (chloroacetic acid).

U. S. Pat. 1,514,067 (Kohnstamm Co.—1924): using stannous chloride as a chlorine adsorbing agent (antichlor) added to the laundry sour. U. S. Pat. 1,483,519 (Kohnstamm Co.): using fluorides or silicofluorides for the same purpose.

U. S. Pat. 2,484,545 (Alrose Chemical Co.) has been digested in REPORTER 1950, 97.

NEWS

• AATCC Members Named to Advisory Committee

The Industrial Waste Division of the Bureau of Stream Pollution of the Pennsylvania Dept of Health has appointed a Textile Advisory Committee to establish standards of textile waste to aid the program of clean streams for Pennsylvania.

Those appointed were: W H Hughes, Chairman, Phila Textile Institute, I P Davis, American Viscose Corp, A W Etchells, Hellwig Dyeing Corp, T H Hart, Hart Products Corp, Dr M J Reider, George W Bollman & Co.

Other members will be added as the work progresses.

• Apex Celebrates Golden Anniversary

In commemoration of its 50th Anniversary, Apex Chemical Co, Inc tendered a dinner to its key employees last month at the Hotel New Yorker. The guest of honor was the founder and Treasurer, Hugo Helburn, who simultaneously enjoyed his 92nd birthday. The master-of-ceremonies and President, Herman Rothstein, announced the payment of 4 weeks extra pay to all employees as a Christmas Bonus. Apex maintains its sales office in New York and its plant in Elizabethport, N J.

• WCC to Expand Research Activities

Construction of a new research center and expansion of the research and development activities of Wyandotte Chemicals Corporation has been announced by Robert B Semple, President.

The Research Center will be housed in a functionally engineered two-story structure to be constructed immediately near the company's administration building in Wyandotte, Michigan, a community on the Detroit River southwest of Detroit. The center will be approximately a city block long and a half block wide and will operate under the general direction of Dr Thomas H Vaughn, vice president in charge of research and development. Occupancy is scheduled for mid-1952.

The company states that the center will permit a consolidation of their many research and development activities and also will enable them to materially expand their scientific and technical staff to handle long range research within the organic and inorganic chemical fields as well as special research projects assumed in behalf of the defense program.

Principal scientific groups which will work in the new center will be concerned with research investigations in the fields of atomic tracers, physics, electronics, bacteriology, organic and inorganic chemistry, and detergency in the industrial, textile, and food technology fields.

• N C State Graduates 30 from Textile School

The North Carolina State College graduated 30 students from the School of Textiles at the end of the fall term on December 14. The list of graduates follows:

J J Allen, Greenville, N C; J C Ashworth, Seagrove, N C; R G Barnard, Cramerton, N C; Ernest Benites, Guatemala City, Guatemala; F A Calhoun, Laurel Hill, N C; W T Cheatham, Jr, Burlington, N C; L W Christian, Hamlet, N C; J L Clements, North Wilkesboro, N C; W P Davis, Warrenton, N C; S O Gluck, New York, N Y; Harry Grossman, Jr, Kannapolis, N C; J J Harand, Tenafly, N J; R E Holland, Conover, N C; D T Horning, Charlotte, N C; E Katzin, Winston-Salem, N C; T H Lingle, Salisbury, N C; W C Muller, Merion Station, Pa; W H Musser, Frankfort, W Va; G E Newton, Yonkers, N Y; C D Page, Jr, Northfield, Minn; A E Pickett, Lumberton, N C; R H Scarboro, Bessemer City, N C; Wayne Shore, East Bend, N C; N K R Sorenson, Oslo, Norway; F R Taylor, Charlotte, N C; F K Thayer, Troy, N C; R L Trotter, Jr, New Hill, N C; H R Turner, Greenville, S C; B J Zachary, Mooresville, N C; and S F Zuniga, Mexico City, Mexico.

• Reliance Establishes New Branch Offices

The Reliance Electric & Engineering Company has established new branch sales offices in Newark, N J and El Dorado, Ark. The Syracuse district office, which directed the Company's sales throughout northern and western New York, has been transferred to Buffalo. With the creation of these new offices, E E Helm, sales vice president has named eight field sales engineers. (See "Personnel" section).

• Auto Telephones and Airplane Speed Rodney Hunt Service

Sales engineers of the Rodney Hunt Machine Co, Orange, Mass, are now reaching New England and Middle Atlantic textile and paper mills in a matter of hours by means of a four-passenger Beechcraft Bonanza. In addition, to speed up the daily activity of sales engineers who spend all their time in the field, the company is experimenting with radio telephones installed in the dashboards of company automobiles, enabling them to maintain close contact at all times with customers and the home office.

At present Rodney Hunt is using the automobile telephones only in the New England and New York areas where Bell System telephone offices equipped to handle radio calls are spaced close enough together to make the idea practical for them.

A company official states: "For years, close contact with our widely scattered customers had been a time-consuming, expensive, and sometimes downright impossible operation. The airplane has really licked the distance problem for us. In a single day our sales engineers and other executives can fly to any section of New England or the Middle Atlantic states, transact business, and return before nightfall. To reach more distant points, the plane carries our men to airports where they can connect with major airlines. And when customers wish to visit our plant at Orange, the plane is often used to save them valuable time."

Rodney Hunt's Beechcraft Bonanza with Pilot Clint Sperry

• OBSW Christmas Party

The annual Christmas Party of the Original Bradford Soap Works, Inc, W Warwick, R I, was held this year at the Dreyfus Frog Farm on Saturday, December 23, with all employees and their wives present as Company guests. The dinner consisted of sirloin beef au jus and was followed by entertainment furnished by the employees.

Daniel R McIver, president, acted as toastmaster and presented bonus checks amounting to approximately 25% of the annual income for all those employed five years or over. Others received amounts commensurate with the time they had been employed. Ernest L Goodman of Ward, Fisher & Company, the Company auditor, explained in detail the recently adopted Pension Plan. (Announcement of the Plan was made recently by Daniel McIver, OBSW secretary and treasurer. It provides for monthly retirement incomes of $120 minimum up to $200 maximum, including social security benefits, for all member employees reaching 65, and also life insurance coverage. The amount of pension and life insurance benefits will be determined in relation to an employee's compensation and length of service with the company.)

Mr McIver stated that full-time employees who are between 24 and 51 and who have been with the company two years are eligible to join the plan. He also stated that three-fourths of the plan's cost will be borne by the company and one-fourth by the employees. The plan is underwritten bv Phoenix Mutual Life Insurance Company of Hartford.

• Sindar to Issue Soap Patent Licenses

The Sindar Corporation, 330 W 42nd St, New York 18, N Y, has announced that they will issue "at reasonable royalty rates" licenses under U S P 2,535,077, relating to germicidal soaps.

The patent, issued to Sindar on December 26, 1950, was based on the findings of Drs Eric C Kunz and Wm S Gump of Givaudan-Delawanna, Inc (with which Sindar is affiliated) to the effect that certain phenolic germicides, unlike other phenolics that had previously been tried and failed, render soap germicidal when incorporated therein in small amounts. These germicides are the 2,2'-dihydroxy halogenated diphenyl methanes, such as the compound with the chemical name of 2,2'-dihydroxy-3,5,6,3',5',6'-hexachloro diphenyl methane, known under the generic name of hexachlorophene, Sindar's brand being called G-11.*

* Reg U S Pat Off.

• NACL to Handle ACC Canadian Distribution

American Cyanamid Company has announced that, as of January 1, 1951, products of its Industrial Chemicals Division and Coating Resins Department of the Plastics and Resins Division, will be distributed throughout Canada by its subsidiary, North American Cyanamid Limited. Sales offices for these two units will be located in Montreal, Quebec (7335 St Lawrence Blvd) and in Toronto, Ontario (Royal Bank Building). North American Cyanamid Limited has for some time distributed products of American Cyanamid Company's Calco Chemical Division, Agricultural Chemicals Division, Mineral Dressing Division, Plastics and Resins Division, and Lederle Laboratories Division.

The Company also has announced that an option has been taken on a proposed site in Montreal for a building or buildings which house not only all sales offices and warehouse facilities, but Lederle manufacturing operations as well. The Company hopes to have construction finished by the end of 1951.

North American Cyanamid Limited is the outgrowth of the parent company's first plant, built in 1907 at Niagara Falls, Ontario. It also operates the Welland Chemical Works, located at Port Robinson, Ontario. The Welland Plant was built and operated by Chemical Construction Corporation (A Cyanamid subsidiary) and produced during World War II new war materials for the British and Canadian Governments. Today, it produces ammonium nitrate and other chemicals.

• Glass Fibers, Inc Leases Toledo Offices

Glass Fibers, Inc of Waterville, Ohio has signed a lease for the entire second floor area of the new building being constructed at 1810 Madison Avenue, Toledo, Ohio, by The Manhattan Building Company. Announcement of the proposed tenancy was made jointly by F H May, Jr, Vice President of Glass Fibers and by George Banta, Secretary-Treasurer of the building organization.

The floor area, totaling 7,620 square feet, will be occupied by the executive, administrative and sales staffs of the glass concern. Space design features an automatic elevator, a reception room of modern decor and a combination of solid masonry, heavy plate glass and metal-wall partitions for the individual offices. An extensive display room, utilizing latest techniques, will house prime and end products made of glass fiber materials.

Completion of the new space is set for early March when the executive group will move from present offices.

• National Bureau of Standards Semicentennial

The year 1951 marks the fiftieth anniversary of the National Bureau of Standards and a large number of the principal scientific and technical organizations of the nation, in recognition of the role of the Bureau in science, have planned meetings in Washington in 1951 to honor the Bureau's Semicentennial. Some of the meetings have regularly been held in Washington in the past; most of them were planned for Washington by the societies in view of the Bureau's Semicentennial.

Among those meeting are the following: Inter-Society Color Council, February 28; Optical Society of America, February 28, March 1-3; Electrochemical Society, April 8-12; APS Division of High Polymer Physics, April 26-28; Analytical Division of the American Chemical Society, June 14-16; Illuminating Engineering Society, August 26-31, September 1; International Union of Chemistry, September 13-15.

In addition, a number of committee conferences and meetings of local sections of societies will be held at the National Bureau of Standards. The Bureau is also planning a series of symposia on special topics, to be held during the year.

Created by Act of Congress on March 3, 1901, the Bureau is the principal agency of the Federal Government for fundamental research in physics, mathematics, chemistry, and engineering. The Bureau's activities are thus largely concerned with the physical sciences although the close inter-relationships of the major fields of science preclude the drawing of sharp lines of distinction.

The history of the Bureau actually extends back to the Constitution, which gave cognizance of weights and measures to the Federal Government. An Office of Weights and Measures grew out of various acts of Congress beginning in 1830, and this Office was the immediate antecedent of the Bureau.

• Ward Summarizes Textile Institute 1950 Activities

We are indebted to Norris Ward, Development Officer of The Textile Institute for the following general summary of that organization's activities for 1950:

"The progress made by the Textile Institute since 1946 gave added significance to the celebration, during 1950, of the twenty-first anniversary of the grant of the Institute's Royal Charter, and of the fortieth anniversary of its formation.

"During the year, 657 new members were elected. Since January 1946, 3,586 new members have joined the Institute, and total membership now exceeds 5,200.

The post-war trend has been one of increasing interest by students and young people in textile technology, and this continued during 1950, when more than a third of those joining the Institute were under the age of 25.

"The number of candidates for the Institute's annual examination in General Textile Technology again increased, to the record figure of 192. The number successful—74—was also the highest yet recorded. For the National Certificate examinations there were 301 entrants, of whom 231 were successful. These results follow on the special efforts the Institute is making to ensure a more adequate supply of trained personnel to deal with the increasingly complex technical aspects of the textile industry. These efforts include the award of special places at the Institute's annual conference (of which nine were again made available to selected students), the award of scholarships (provision for the eighth award of the Cotton Industry War Memorial Trust Scholarship was made during the year), and the holding of annual competitions (for which prizes exceeding £160 were competed for).

"Conferences have again played an important part in the Institute's programme. At the annual conference at Cheltenham, over 200 members and visitors discussed yarn irregularities, and special subjects have been discussed at one day conferences. At Macclesfield in February the preparation of continuous filament yarn was discussed; at Morley in April the subject was the reclamation of fibers, and at Burnley in October consideration was given to the question of yarn preparation.

"The work done by the Institute since the war has placed a heavy burden on its finances, and has made possible only by the Development Fund of over £20,000 raised in 1946, most of which has now been utilized. There was a welcome respite for the Institute in 1950 by the election of more than a hundred firms as Patrons. Contributions from these and other sources will enable it to continue its present high level of activity.

"In particular, it is hoped that the Institute's work in the field of publication of important technical work will benefit. Towards the end of the year it published Volume I of a Review of Textile Progress, and the third issue of its Year Book, and had a number of other publications in course of preparation."

• Defoliating Chemicals Reported Nondetrimental to Dyeing

Recent tests according to the National Cotton Council indicate that chemicals used to defoliate cotton and those applied as herbicides to control weeds and grass in cotton have no detrimental effect on the dyeing qualities of cotton fibers.

The tests and plans for additional studies in this field were among research findings discussed by defoliation workers attending the fifth annual Beltwide Cotton Defoliation Conference in Memphis, January 11-12, sponsored by the National Cotton Council.

In the experiments, samples of cotton were obtained from plots where 12 different defoliation methods had been followed and from one check plot which was not defoliated. Normal procedures were carried out in growing and defoliating the cotton, all of which was machine picked.

After the cotton was harvested and ginned it was classed to obtain grade and staple. To determine the effect on the color of the fibers the samples were tested in the new automatic cotton colorimeter. To further study the effect of the various defoliants on the end use properties of the fiber, samples were subjected to certain dyeing and bleaching tests at Avondale Mills in Alabama. Similar procedures were followed with samples from plots where different herbicides were applied to control weeds and grass.

Cooperating in the experiments were the Division of Cotton and Other Fiber Crops and Diseases, USDA; the Arkansas Agricultural Experiment Station; the Cotton Branch, Production and Marketing Administration; Avondale Mills; and the National Cotton Council.

• Burlington Establishes Facilities in L A

Marking their first manufacturing establishment on the West Coast, Burlington Mills has completed the purchase of the plant and facilities of Arthur Bone, Inc, rayon piece goods and hosiery dyeing and finishing firm located at Worth Street in Los Angeles.

Robert L Huffines, Jr, President of Burlington Mills Corp (N Y), said the facilities of the Bone plant will be modernized with the newest equipment, doubled in capacity and that hosiery dyeing and finishing operations will be added as quickly as possible. Stewart Bone, vice president and general manager of the firm, will continue with the Burlington organization and will be in charge of the expanded manufacturing operation.

The Burlington merchandising head pointed out that the textile firm has recently consolidated its Burlington Mills California Corp offices and enlarged the merchandising staff in both Los Angeles and San Francisco. Charles Finlayson, with offices at 714 South Los Angeles Street, is in charge of the Burlington Mills California Corp.

• U S Rubber Buys Esso Rubber Plant

In a major step in its expansion of facilities for manufacture of chemicals, plastics and synthetic rubbers, the United States Rubber Company has purchased the Buna-N synthetic rubber plant of the Esso Standard Oil Company in Baton Rouge, La. The purchase price was not disclosed. The plant will be operated by the Naugatuck chemical division, which will continue to market Buna-N rubber under the trade name paracil.

Among the reasons for purchase stated by John P Coe, vice president and general manager of Naugatuck, was that of increasing facilities to produce high styrene copolymer latex in demand by the textile industry for various specialty applications.

The plant now has the capacity to produce approximately 15,000,000 pounds of Buna-N synthetic rubber and high styrene latex annually. U S Rubber plans to expand that figure to more than 30,000,000 pounds annually, including new rubber-plastic blends.

Completed in 1941, the plant is situated on a tract of land adjoining the Esso Standard Oil Refinery at Baton Rouge. It is one of the most modern of its type and has good rail, highway and water transportation facilities.

The first batch of GR-S all-purpose synthetic rubber produced in the United States was made at this plant in December 1941 under a cooperative program by technicians of Esso Standard Oil Co and U S Rubber Co.

This is the second major expansion announced by Naugatuck Chemical during the past year. On December 31, 1949, it acquired the Painesville, Ohio, vinyl resin plant of Glenn L Martin Co together with the trade name Marvinol and laboratory facilities in Baltimore, Md.

• New Columbia Chemical Division Plant in Construction

The Columbia Chemical Division of Pittsburgh Plate Glass Company has under construction in Natrium, W Va a new plant designed for the production of benzene hexachloride, according to an announcement by E T Asplundh, vice president. Commonly called BHC, this organic chemical is produced through the reaction of chlorine and benzene.

Completion date of the new plant should be during March or April, 1951 but inability of equipment manufacturers in meeting delivery schedules could delay placing the new facility in production.

Columbia's Natrium facilities also produce chlorine, caustic soda, muriatic acid and chlorinated benzenes.

• News of DCAT Activities

Hon Oscar R Ewing, Federal Security Administrator, will address the luncheon meeting of the DCAT this Friday (January 26) at the Hotel Astor. The subject of Mr Ewing's talk will be the function of the Federal Security Administrator as Claimant Agency for health supplies under the Defense Production Act of 1950 and the NPA.

* * *

Charles P Walker, Jr (Director & Gen'l Sales Mgr, Chas Pfizer & Co, Inc), DCAT Chairman, has announced that the dates of September 20-22, 1951, have been set for the Section's 61st Annual Meeting and Election. Following a report of the Committee on Location at the Executive Committee meeting on December 21st, a decision was reached to return to Shawnee Inn, Shawnee-on-Delaware, Pa for next year's meeting.

* * *

The following chairmen have been appointed by Mr Walker to head committees for the 25th Annual DCAT Dinner to be held on March 8, 1951 at the Waldorf-Astoria: Charles M Macauley (Pro-phy-lactic Brush Co), *Dinner Arrangements Committee;* Harold C Green (L Sonneborn Sons, Inc), *Program Committee;* Robert B Magnus (Magnus, Mabee & Reynard, Inc), *Honor Guest Committee,* assisted by Fred G Singer (E I duPont de Nemours & Co, Inc) as Vice Chairman; Murray Breese (Murray Breese Associates), *Publicity Committee,* assisted by George S McMillan (Bristol-Myers Company) as Vice Chairman; Lloyd I Volckening (The Ivers-Lee Company), *Reception Committee,* assisted by James G Flanagan (S B Penick & Company) as Vice Chairman.

• Bakelite Records 1950 Advances

Bakelite Division, Union Carbide and Carbon Corporation, reports that advances were made in the past year despite a particularly difficult last-half year. Raw materials shortages, increased use of plastics, and mounting military demands were factors contributing to the many difficulties and uncertainties existing in 1950, the company states.

George C Miller and C W Blount, vice presidents and general sales managers, respectively, of Bakelite Division's Thermoplastics and Thermosetting Departments, expect that 1951 will probably follow the pattern of the last half of the previous year. However, they point out that increased production facilities during the middle of the coming year should tend to prevent the shortages from becoming more acute, provided raw materials can be obtained to operate production facilities at full rate.

Work stoppages in the plants of various chlorine suppliers, according to Mr Miller, limited the production of vinyl resins, beginning in June and continuing through 1950. However, he states, the plastic industry's production of vinyl resins for 1951 is expected to be in excess of 400,000 pounds if raw materials can be obtained for this rate.

Mr Blount cited slow downs and strikes in the soft coal mining and steel industries as being among the primary reasons for shortages of benzol and natural coal tar acids needed in the manufacture of phenolic materials. To compensate, however, Bakelite's new phenol plant will begin operation during the first quarter of 1951, and is expecting to aid materially in easing the shortage.

Both polyethylene and styrene are expected to be in particularly short supply during 1951. Although a great many new uses were developed for polyethylene during the past year, it appears likely that many of them must be deferred because of the increasing military demands for this material.

The demand for plasticized film and sheeting is expected to be greater in 1951. The increased demand for plastic film is expected because of its continuing advances in fields traditionally served by textiles, ie, the introduction of specially processed materials to duplicate with excellent fidelity almost any fabric, pattern or weave. These new surface effects and textures are expected to greatly enhance the acceptability of this material for home decoration, household, and fashion uses.

• Du Pont Awards 78 Fellowships

The du Pont Company has awarded 72 post-graduate and 6 post-doctoral fellowships to 47 universities, and grants-in-aid to 10 universities for the 1951-52 academic year in an attempt to "stock-pile knowledge through the advancement of fundamental research". An authorization of $390,400 has been provided for the program.

Granting of the fellowships is a continuation of the company's plan originated in 1918 to encourage graduate research in chemistry. It has since been expanded to include other fields.

The grants-in-aid to universities are for unrestricted use in the field of fundamental chemical research. They provide $10,000 for each of 10 universities, all of which received similar awards for the present school year. The company also provided $20,000 to the University of Chicago for a calendar year 1951 membership in its Institute for the Study of Metals.

• Koppers Chemical Division Reports Higher 1950 Sales

Along with other divisions, the Koppers Company Chemical Division, formed only four years ago, reports consistently higher sales in 1950 than those of 1949, as well as marked progress in the chemical and plastics fields.

In a year-end statement, General Brehon Somervell, Chairman and President, asserted that "Koppers Company, Inc, will enter the year 1951 with facilities geared to produce at high levels, not only for the needs of its civilian customers but also to meet whatever work the Company is called upon to perform for the national defense".

"Of Koppers present backlog of orders, only about 8 percent is attributable to direct military orders for military goods," Gen Somervell stated, "but Koppers stands ready to quickly convert such of its facilities as are applicable to defense production, if and when requested to do so by the government."

• Day-Glo Apparel News

Daylight fluorescent textiles have attracted so much attention in recent months that Switzer Brothers, Inc, 4732 St Clair Avenue, Cleveland 3, Ohio, have inaugurated a new publication, "Day-Glo Apparel News", designed to answer the questions being asked about them. At present it is being mailed at monthly intervals to approximately 25,000 apparel manufacturers, department stores, specialty shops and resident buyers. (Switzer states that they will be glad to add those interested to their mailing list.)

The initial copy in November employed a masthead flocked with Day-Glo Saturn Yellow Fluorescent Flock. Future issues will be similarly decorated with the six Day-Glo colors in turn.

• ACMI 1951 Fiber Testing Classes Schedule

The American Cotton Manufacturers Institute, Inc has announced dates for the 1951 classes in cotton fiber testing. The first, already in session, began January 5 in the Institute's Division of Technical Service at Clemson, S C.

The following schedule is tentative:

Opening Date	*Closing Date*
January 5, 1951	March 2, 1951
March 19, 1951	May 11, 1951
May 21, 1951	July 13, 1951
August 6, 1951	September 28, 1951
October 15, 1951	December 7, 1951

Additional information may be obtained from John T Wigington, Director, ACMI Division of Technical Service, Box 151, Clemson, S C.

• SCI Annual Meeting Dates

The Annual Meetings of the Society of Chemical Industry will be held as follows:

1951—London, England, July 9-13

1952—New York, N Y, September. (Details of this meeting are now being worked out and will be announced at an early date.)

• Howard to Be Awarded Perkin Medal

Henry Howard, long prominent in the American chemical industry and for twenty-two years chairman of the executive committee of the Manufacturing Chemists' Association, has been selected to receive the 1951 Perkin Medal, according to an announcement by Gustavus J Esselen, Honorary Chairman of the American Section of the Society of Chemical Industry, which sponsors the award.

Mr Howard, a native of Jamaica Plain, Boston, Massachusetts, was for thirty-two years connected in various capacities with the Merrimac Chemical Company, now a part of the Monsanto Chemical Company, and for ten years subsequent to that he was successively Director of New Products Departments, Director of Research and Development, and Consultant to the Grasselli Chemical Company, now a part of E I duPont de Nemours & Company, Inc. Eighty-nine United States patents have been issued to Mr Howard, covering principal processes of manufacture of sulfuric and hydrochloric acids, alum and other heavy chemicals, and the specialized equipment required in chemical manufacturing plants.

Mr Howard will receive the 45th impression of the Perkin Medal. It was founded in 1906 in honor of Sir William Perkin, who that year celebrated the fiftieth anniversary of his discovery of the first synthetic dye, and who received the first impression of the medal in honor of that event. The medal is awarded annually to "a member of the chemical profession residing in the United States for outstanding work in applied chemistry." The choice of the recipient is made by the Perkin Medal Award Committee made up of representatives of the American Chemical Society, The Electrochemical Society, the American Institute of Chemical Engineers and the American Section of the Society of Chemical Industry, under the chairmanship of the presiding officer of the last named.

Presentation to Mr Howard will be made in New York on April 27, 1951. Details of that meeting will be announced later. This is an important change from the usual custom of awarding the medal in early January each year.

• United Piece Dye Purchases Charleston Site

John M Rivers, Chairman of the Charleston, N C, Development Board, has announced that the United Piece Dye Works of Lodi, New Jersey acquired title on December 15 to a 44 acre site just west of the City Waterworks at Hanahan Station between U S Highway 52 and the Atlantic Coast Line Railroad, where they will erect a large plant for the finishing, dyeing and printing of textile fabrics.

No announcement has been made as to the total cost of the plant and equipment, but the first unit of the plant reportedly will cost in excess of one million dollars and will provide initial employment for 200 men. The site selected provides ample room for expansion.

All surveys, test borings and other preliminary work has been completed and ground was broken Tuesday, December 13th.

Charles Blount, Jr, President of the United Piece Dye Works announced that construction would be completed sometime during 1951 and operations are expected to be under way not later than September 1, 1951.

Francisco & Jacobus, civil and industrial engineers of New York are in charge of the design of the plant building and equipment layout. Steel and other critical building materials have been on order for the past six weeks and construction will be rushed as fast as possible. The site has been under option for the past six months but formal announcement of the company's plans was delayed until details of all contracts were worked out.

"We are very anxious to get into operation", Mr Blount said, "and with the exception of a few key men, all workers will be sought locally".

NEW PRODUCTS

• Synthetic Carbazole

Synthetic Carbazole ($C_{12}H_9N$) now is available in commercial quantities from Reilly Tar & Chemical Corp, Indianapolis, Ind, with the recent activation of a newly-perfected process developed by the Research & Development Division. According to Dr F E Cislak, Reilly Director of Research, the new process frees industry from uncertain reliance upon the production of Carbazole from the usual coal tar method with adequate supplies now assured.

As the basic raw material for the hydrone series of dyes, Carbazole has been known to the dyestuff industry for many years. It is also useful in the manufacture of explosives and in organic syntheses.

Among the newer uses for Carbazole cited by the manufacturer are: interaction with acetylene to form vinyl carbazole, alkylation to form lubricants, nitration and halogenation to make insecticides, use as a rubber antioxidant, and use to inhibit rancid odors in synthetic detergents.

The product has a molecular weight of 167 and a purity of 97% minimum. It boils at approximately 353.5° C, and its initial melting point is 245° C. The product is also reported to be insoluble in water, slightly soluble in alcohols and aromatic hydrocarbons and very soluble in pyridine bases.

• G E Announces New Pyrometer Equipment

General Electric's Meter and Instrument Divisions have disclosed new pyrometer equipment offering accurate temperature indication, close temperature control of industrial processes and protection for furnaces, ovens and kilns. The complete line consists of flush- or surface-mounted indicators, controllers and protectors.

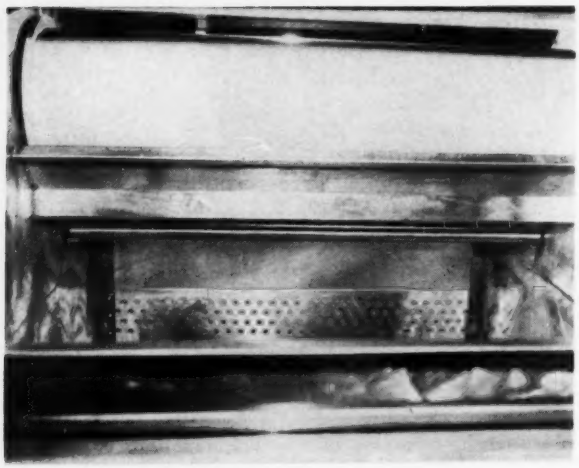
Industrial applications include heat treating furnaces; brick, cement or ceramic kilns; melting furnaces, cooking kettles, plastic molding machines, impregnating tanks and cloth-treating ovens. The equipment is said to have a calibrated accuracy within ¾ of 1 per cent of full scale and a legible 7-inch scale, fitted with an anti-glare cover, to indicate any change in temperature equivalent to 1/10 of 1 per cent of full scale. Control action is immediate and normal changes in humidity, ambient temperature and voltage have little or no effect on the exactness of the control action, it is reported.

The heart of the indicating instrument is a 3¼-pound magnet, which provides higher flux density and allows larger air gaps than are found in conventional instruments. The manufacturer states that foreign matter will not impair the operation of the instrument since the indicator is so sealed that it can be installed in humid or dirty locations.

The indicating device is a millivoltmeter that is connected to a thermocouple on the furnace or other heating equipment. The difference between the hot and cold junctions of the thermocouple causes small voltages, which, being proportional to the temperature, are indicated on a scale marked in Fahrenheit or Centigrade.

The Type HP-3 controller provides On-Off action of the final control element by either a relay, mercury switch, or a contactor through which electric power is supplied to the furnace or oven.

The pyrometer protector, a separate form of the HP-3, is usually used in conjunction with and to protect against the possible failure of a separate precision controller.



R & L Variable Height Weir

• Variable Height Weir for Continuous Washer

As part of a system designed to assure positive counter current flow of liquor (with uniform predetermined level) in each tub of their "Laxloop" continuous washer, Riggs & Lombard of Lowell, Mass has introduced a new variable height weir.

Each tub is equipped with a weir and all liquor that flows over it is pumped to the preceding tub by a stainless steel, flooded suction, low-head type pump.

• Structuralized Color Guide

A new system for making color mixing and naming rapid and easy has been advanced by Structuralized Color Guides, Santa Fe, N M, a Division of Hiler Color Systems. Over 500 colors, authentic color names and mixing directions for each color are included in the Structuralized Color Guide. A copyright Color Harmony Indicator gives instant complementary and triadic harmonies.

A unique feature is the elimination of cross-mixing to achieve various color shades. List price: $5.75.

For information write to Dept ADR, Structuralized Color Guides, 640 Camino de la Luz, Santa Fe, New Mexico.

• Polyvinyl Copolymer Emulsion

The American Polymer Corp, Peabody, Mass, has announced an emulsion to combat brittleness and inadequate resistance to grease and solvents in industrial floorings. The emulsion is called Polyco 1673-37B Polyvinyl Acetate Copolymer. The manufacturer states that Polyvinyl Copolymer based floors are more permanent towards aging or cracking, and are superior to rubber floors in their resistance to abrasion, alkalis, oils, greases and petroleum products.

PERSONNEL

WILLIAM L HEWES, assistant director of purchases for the Hercules Powder Company retired on December 31 after 41 years of service. He joined the Du-Pont Company in Wilmington in 1910, and became associated with Hercules Powder Company four years later as a member of the Accounting Department. Late in 1914, he was named assistant purchasing agent of the company. The title was changed to assistant director of purchases in 1926.

JAMES EDWARD TIPTON, a 1950 graduate of James Millikin University, has been employed as a research junior chemist in the technical department of the A E Staley Manufacturing Company, corn and soybean processor, according to L O Gill, technical director.

DONALD D PASCAL has been named Vice President, in Charge of Sales of National Starch Products Inc. His headquarters will be in New York City. Mr Pascal has been Vice President of the company, in charge of Eastern and Pacific Coast Sales Divisions.

S F THUNE, Sales Manager of the Mid Western Division, will become General Manager of that Division. He has been associated with the Company since 1934, in various capacities.

LESTER KLEMPNER, at present Sales Manager of the New York Division, will also become Sales Manager of the Eastern Division, which extends from Maine to Florida.

Mr. Klempner joined National Adhesives in January of 1935.

CHARLES P YATES

CHARLES P YATES, personnel manager of William Iselin & Co, has been promoted to assistant treasurer. Mr Yates has been with Iselin since 1933, except for an interim period of three years during World War II. He was transferred to the Grand Rapids office of the company about January 1, 1951, to head up the financial department of that office, as well as to take over general administrative duties.

C B ALLEN, sales engineer in Reliance Electric and Engineering Company's Detroit office for the past five years, becomes district manager in Buffalo, heading up the work formerly handled from Syracuse by G E BEVIS, now a vice president of the recently acquired Canadian division of Reliance at Welland, Ontario.

WILLIAM H BREHMER, sales engineer in Buffalo while it was a branch office, moves to Syracuse to head branch operations there.

Two sales engineers from Reliance's New York office will staff the new office at 1060 Broad Street, Newark, New Jersey. ELWOOD H KOONTZ, who joined the company in 1936 becomes the branch manager, and F R OBENCHAIN, with Reliance since 1941, joins him as sales engineer.

R C SUTTLE, sales engineer in the Cincinnati office for the past two years, has been made manager of the new office at 202 Washington Avenue, El Dorado, Arkansas.

W C McCONNELL,, who has been directing sales at the Reliance office recently opened in Charleston, West Virginia, succeeds Mr Allen in Detroit.

C V HARP, JR, transferred from Houston, replaces Mr McConnell at Charleston, and R I CORYELL, JR, sales engineer at Syracuse since last March replaces Mr Suttle in Cincinnati.

WILLIAM H RUFFIN, president of Erwin Mills, Durham N C, has resigned as first vice-president of the American Cotton Manufacturers Institute to accept the presidency of the National Association of Manufacturers.

Paul Weller

PAUL WELLER has been appointed district manager, Cincinnati office, of the Michigan Alkali Division, Wyandotte Chemicals Corporation. He joined Wyandotte Chemicals Corporation in 1945 as a market research analyst. Previously he had been associated with Goodyear Tire & Rubber Co as a development engineer.

ED HEISER will assume the position of field supervisor of alkali sales, Cincinnati office.

ROBERT FOSBURG, presently field supervisor of the calcium chloride department, is being transferred as senior sales representative to the New York office.

Other Wyandotte appointments that took effect January 1 are as follows:

CHAS S SANBORN—manager, market research department.

C J FARCASIN—field supervisor, calcium chloride department, Cincinnati office.

J M NORCOTT (transferred to the J B Ford Division)—manager, Pacific industrial chemicals department.

DR D B KEYES' resignation as Vice-President of Heyden Chemical Corporation became effective on December 31. However, Dr Keyes, a Director of the Company, will continue in the capacity of a special consultant.

EDWARD SALNER has been appointed manager of the Precipitator Department of the Metal Products Division of Koppers Company, Inc. He succeeds Frank H Linthicum, who died on December 11. Mr Salner joined Koppers in their Metal Products Division as personnel manager in 1939.

NORMAN W JAMES, General Purchasing Agent of the Pennsylvania Salt Manufacturing Company, Philadelphia, withdrew from active service with the company on December 31, but he will continue as a consultant and advisor on procurement problems. Mr James joined the company in 1905 in the Accounting Dep't.

FREDERICK G PRINCE, former Assistant General Purchasing Agent succeeds Mr James. Mr Prince joined Pennsalt at the time of the purchase of the assets of Sterling Products Company in 1939.

TECHNICAL LITERATURE

"Clean Water is Everybody's Business"—Federal Security Agency, Public Health Service (Publication No. 11), Washington 25, D C—A pattern for intergovernmental and civic cooperative action on the growing problem of pollution of the nation's water resources.

The booklet describes the effect of water pollution on all aspects of life, especially health, business, and recreation, and points out the need for cooperation among communities, industry, and State and Federal Governments in pollution prevention and abatement. It explains how in five steps a program of public action can be carried out to develop comprehensive water pollution control programs, stimulate construction of treatment works, provide technical aid and research, encourage recovery and use of waste products, and invoke enforcement measures when necessary.

Recognizing water pollution as a product of the industrial age which has developed large population centers during the past century, the booklet points out that nearly half of the population now lives in 140 metropolitan districts covering only 1½ percent of the total land area of the country. Industrial production has more than doubled since 1935. The amount of pollution discharged into streams by communities and industries is equivalent to the untreated sewage from a population of more than 150,000,000 persons, but over half of this is produced by industrial wastes, it is shown.

Suggestions to citizens of communities on how to obtain information on the water pollution problem from their local officials, State authorities or the Public Health Service are offered.

"Labor Relations Work Kit"—National Foreman's Institute, Inc, New London, Conn. Over 200 pages. Price $7.50. Edited by Lawrence Stessin with the assistance of staff of the Employee Relations Bulletin.

This manual is designed to put the labor relations and personnel man in touch with some of the more successful techniques worked out by companies who have come up with workable solutions for particular problems. It does not theorize, but actually names the companys which worked out the individual or collective problems, together with step-by-step procedures toward solution and visual illustrations.

Penfield Pays Folio—Penfield Manufacturing Co, 19 High School Ave, Meriden, Conn. Contains catalog sheets and other information on Penfield Ion Exchange system ranging in capacity from 30 to 1,000 gallons per hour. Each catalog sheet, in addition to containing a photographic illustration and working diagram of each model, also lists a complete description of parts and features both performance and specifications charts.

A prospective user can figure the chemical costs of operating a particular model unit under his own raw water conditions by referring to the "Total Ionized Solids in Raw Water" column of the performance chart. Should the solids content of the prospective user's water not be readily available, Penfield states that they will provide a complete analysis at no charge upon receipt of a one quart sample.

Copies may be secured by writing to Edward H Clohessy at the Company's Meriden address.

Pyrometer Equipment—General Electric Meter and Instrument Divisions, Schenectady 5, N Y (Bulletin GEA-5534). Descriptions of the company's complete line of flush- or surface-mounted indicators, controllers and protectors. (See discussion of GE'S new Pyrometer Equipment in the "New Products" Section).

Data Sheet A-33—American Resinous Chemicals Corporation, Peabody, Mass—Covers general purpose emulsions that may be used alone or further compounded for obtaining water-proof bonding. These emulsions are being used currently to replace polyvinyl acetate base emulsions for many wet stick applications.

"Descriptive Color Names Dictionary"—Container Corporation of America, 38 South Dearborn St, Chicago 3, Ill, 64-page supplement to CCA's *Color Harmony Manual*. Contains 775 names arranged for use from names to colors or conversely. All names are those commonly used to describe the color of merchandise in mass markets.

Colorists Helen D Taylor and Lucille Knoche collaborated with Walter C Granville in preparation.

Gaco Neoprene Maintenance Coating and *Gaco Drum Lining*—brochures of the Gates Engineering Company, New Castle, Del. The latter gives data on the company's new vinyl finish for drum linings, which is reported to have a high impact resistance rating and permanent flexibility. Gates recommends use of the product for drums carrying weaker acids, salts, wetting agents, dyes, dispersing agents, alcohol and similar chemicals.

OBITUARY

Ralph E Hale
(A contribution to the
American Dyestuff Reporter)

RALPH E HALE

AT its last meeting of the year 1950, the Northern New England Section of the American Association of Textile Chemists and Colorists elected Ralph Hale as Chairman. For two years he had served the Section as Vice Chairman, planning its technical progress with rare skill and enthusiasm despite a crippling and progressive illness. From his hospital bed he had declined higher office only until he should regain strength to fill it in accordance with his own high ideals. The inspiration of his cheering courage will long outlive the shock of his death on December sixth.

Ralph E Hale was born on December 9th, 1908, son of George E Hale and Etta Hardy Hale of West Newbury, Mass. Entering the Lowell Textile Institute in September, 1927, he worked his way, largely through assistance to instructors, and graduated in June, 1931. He subsequently had but one employer, the Bell Company of Worcester, Mass. In Worcester he was active in the Chemists' Club, which later became the Central Massachusetts Section of the American Chemical Society.

In 1936 he married Louise Hall Butler. Their children are David George Hale, now twelve, and Martha Elizabeth, now nine. A letter from Mrs Hale, received in response to one of inquiry, so clearly illuminates his character and sources of inspiration that it is here published in part, with her kind permission.

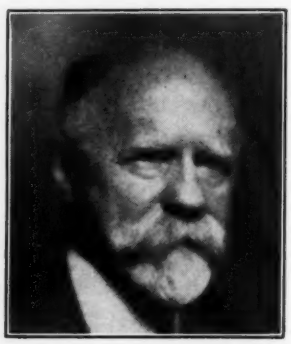
"Ralph was a member of the Appalachian Mountain Club and devoted himself to their activities with the same enthusiasm he gave to anything he liked. He was an officer of the Worcester Chapter for seven years. Snowshoe climbs of Mt Moosilauke and camping in the White Mountain National Park were his favorites.

"Gardening on his hill-top half-acre was always a means of relaxation for Ralph. Small fruits and vegetables took year round planning or care. I wish I knew what he used to do to the grapevines in January. He always planted a great quantity so that we would have enough even if the crop were poor. But Ralph did not have poor crops, and the bounty he received was generously distributed among the neighbors.

"When David was old enough for summer camp, Ralph was invited to join the committee of YMCA men who operate Camp Morgan in Washington, N H. He assumed responsibility for spraying the camp in summer and reducing winter damage done by mice and squirrels. He was very proud of the consequent fine health record of the camp.

"He enjoyed listening to music and was an eager concert-goer. For reading he preferred true accounts of adventure.

"Ralph never tolerated false pretenses, and I'm sure the men and the Association to whom he gave his loyalty and devotion must be very fine indeed."



William Brown Bell

WILLIAM BROWN BELL

WILLIAM BROWN BELL, President of American Cyanamid Company, died of a heart attack on Wednesday, December 20th, at Marrakeech, French Morocco. He was on a business trip surveying the company's interests abroad at the time of his death.

Born February 16, 1879, at Stroudsburg, Pennsylvania, he resided at 1115 Fifth Avenue, New York and at his summer home at Pocono Lake Preserve, Pennsylvania.

Mr Bell, a life long member of the Society of Friends, was graduated from Westtown School, Westtown, Pennsylvania, and from Haverford College, Haverford, Pennsylvania, where he was elected to Phi Beta Kappa and received his BA in 1900. In 1901, he received his MA from the School of Political Science of Columbia University and in 1903 his LLB from the Columbia University School of Law. While studying law, he was a member of the Editorial Board of the Columbia Law Review. Mr Bell was admitted to the New York Bar in 1903 and became associated with the law firm of Guthrie, Henderson and Degersdorff. During the first World War, he gave valuable assistance to the President of the Air Nitrates Corporation as advisor and assistant in building Nitrate Plant No 2 at Muscle Shoals, Alabama. He became President of American Cyanamid Company in 1922.

Mr Bell's integration of the numerous companies merged to form the present American Cyanamid Company was acclaimed by many a major achievement in industrial management. Mr Bell was keenly interested in fostering a strong and capable research organization, and devoted much of his personal attention to it.

Mr Bell was awarded the Chemical Industry's Medal in 1934 for distinguished economic service to the Chemical Industry. He served as Chairman of the Board and President of the Manufacturing Chemists Association and the Chemical Alliance. In this latter organization, he directed its work during the days of NRA and guided the chemical industry through many trying phases.

For many years, Mr Bell had also been a member of the Board of Directors of the National Association of Manufacturers. He was actively interested in its post-war planning work and served as a Regional Vice-President and as a member of the National Industrial Information Committee. At the time of his death, he was an honorary Vice-President. He was largely responsible for instituting the practice of publishing an Annual Platform of the Association.

Active in numerous capacities, he was a Director of the Guaranty Trust Company of New York, a Director of the Alfred P Sloan Foundation, and a former Trustee of the Bank of New York. He had served on the Advisory Board of the Central Hanover Trust Company and was also an active member of the Board of Advisors of the Manufacturers Trust Company. In addition, he was a Director and Chairman of the Board of Jefferson Chemical Company, Inc, Director and Vice-President of Southern Alkali Corporation, and Director of Southern Minerals Corporation.

In addition to the time he devoted to business and industry, Mr Bell took an active interest in the fields of education, travel, politics and economics. He was also a distinguished yachtsman and once owned the "Mistral" and the schooner "Elena." In 1928, with the "Elena," he won the Spanish American "Race" receiving the King's Cup presented to him by the King of Spain. The "Elena" was presented by Mr Bell to the British Admiralty as a gift in 1942.

He is survived by his daughter, his son-in-law, and four grandchildren.

CALCO dyelines

No. 18 of a series

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Off-shade dyelots are kept to a minimum by:

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2. Rigid supervision and standardization of all dyehouse processes. Too many additions to a starting formula and too much manipulation of procedures are frequent causes of off-shade dyeings. Leaky equipment and dirty equipment are obvious causes of off-shade dyeings.
3. Careful sampling, drying and conditioning of hand samples.
4. Adequate records of all changes in shade which customarily occur between the passing of the hand sample in the dyehouse and the final inspection of the shade in the shipping room.
5. Clean working standards for shade, frequently checked against carefully protected master standards.
6. Illumination for color matching which is adequate in intensity, correct in spectral distribution. This should be kept scrupulously clean and should be frequently checked.

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It can be used with Calcocid Fast Red BL Conc. for the red element of combination shades along with Calcocid Blue SAPG and Calcocid Yellow MCG for fading-on-tone properties. It also works well in combinations with Calcocid Fuchsine 6B to produce rich, economical maroons, with good light fastness. *Trade-mark

For the Textile Bookshelf

Optical Bleaches in Household Soaps and Detergents (Calco Technical Bulletin #811) by E. I. Stearns, T. F. Cooke and H. E. Millson. Paper reprinted primarily for distribution to the soap industry, discusses fully the new whitening agents used in soaps and detergents, particularly those which are applicable to cotton.

Lightfastness Ratings of Vat Dyes on Cotton (Calco Technical Bulletin #813) by M. Babey, S. J. Luscian and R. J. G. Schofield. Provides the dyer with more complete and more exact information about the lightfastness of vat colors on cotton.

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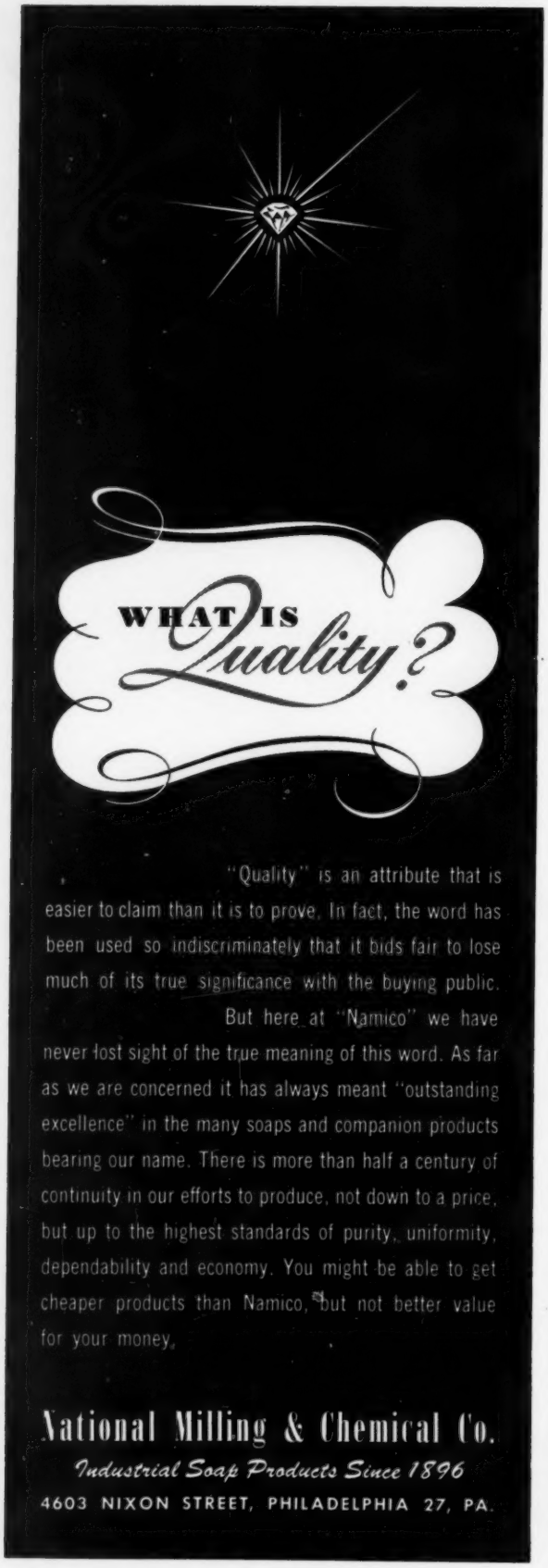
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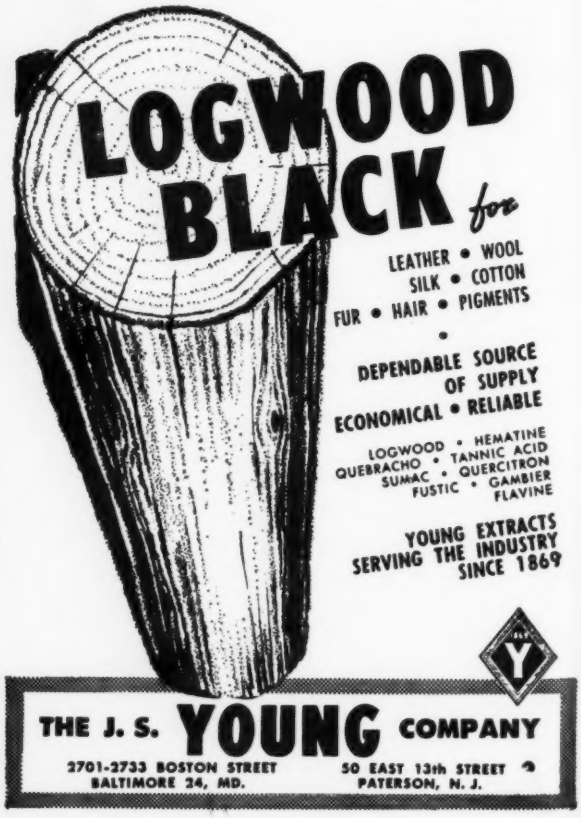
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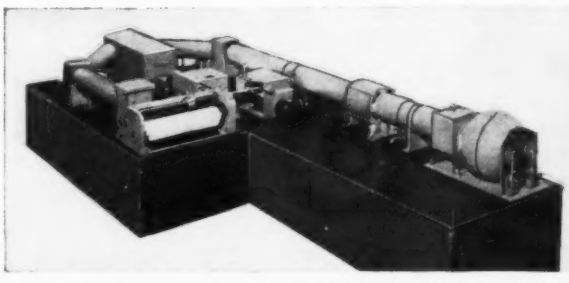

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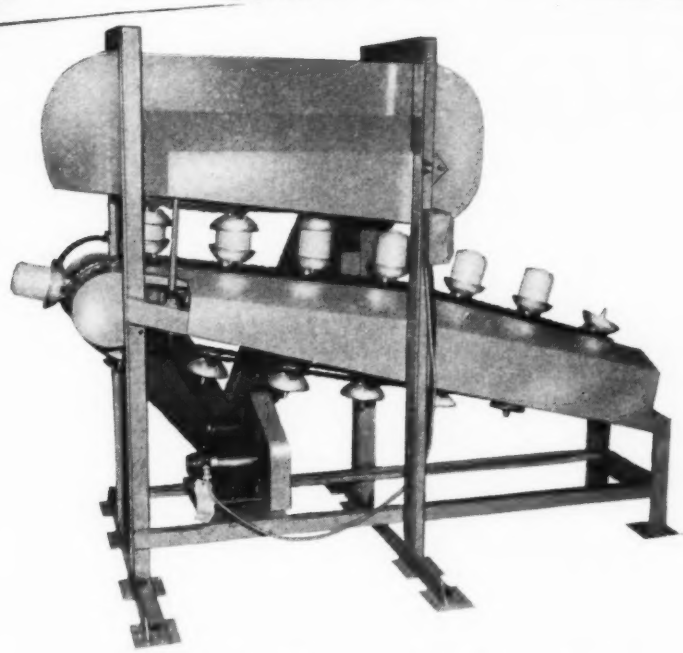

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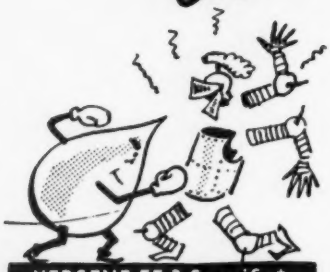

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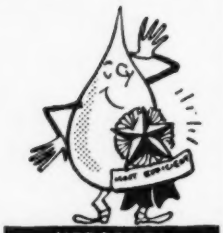

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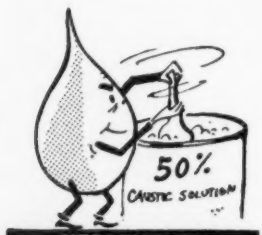

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Wyandotte Chemicals Corp.	
Young Aniline Works, Inc.	
Young Co., J. S.	XXX
Zinsser & Co., Inc.	XXVIII

Original Solvay Plant

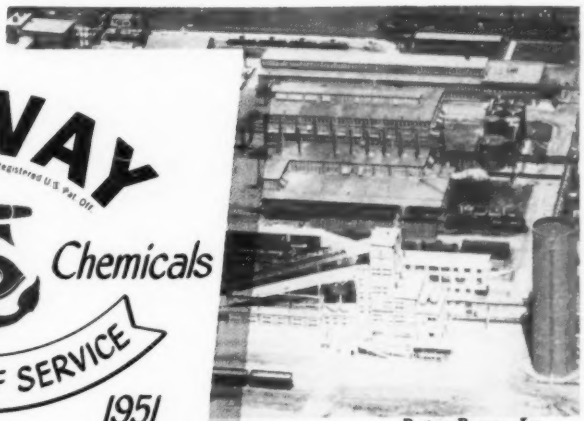
70 Years of PROGRESS

Progress can be measured in many ways...

Our progress, for example, might be measured by comparing our original soda ash plant to our five great plants that today have the world's greatest output of alkalies and associated chemicals. Or we might compare our early technical and research facilities with our present laboratories—the world's largest and best equipped for alkali research.

But the way we like to measure our progress is by the steady year-by-year growth in the number of firms and individuals who continue to "specify Solvay." It is *their* feeling toward Solvay and Solvay Products that has made this progress possible.

Hopewell, Va.



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Alkalies Chemicals

70 YEARS OF SERVICE

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Methanol • Formaldehyde

AMMONIUM AND POTASSIUM PRODUCTS
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Ammonium Bicarbonate
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For Institutional & Industrial Cleaning
For Food Processors
For Bottling Plants
For Breweries
For Dairies

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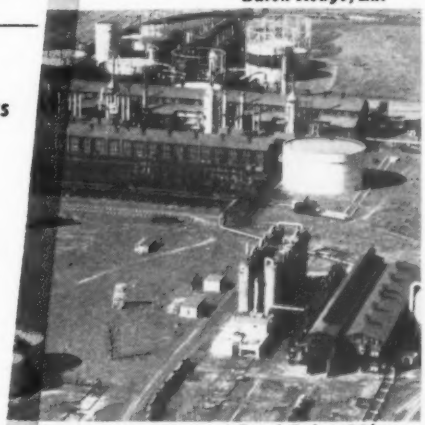
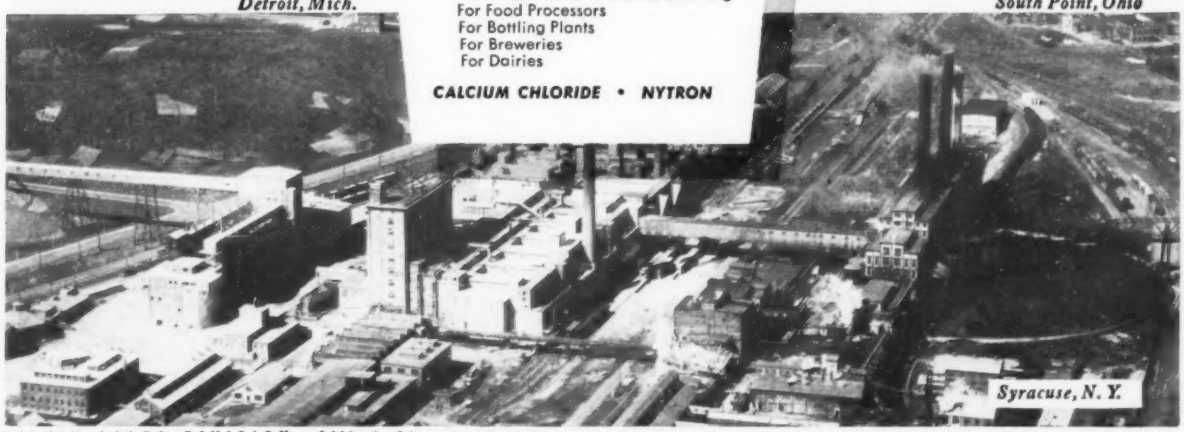
Detroit, Mich.



South Point, Ohio



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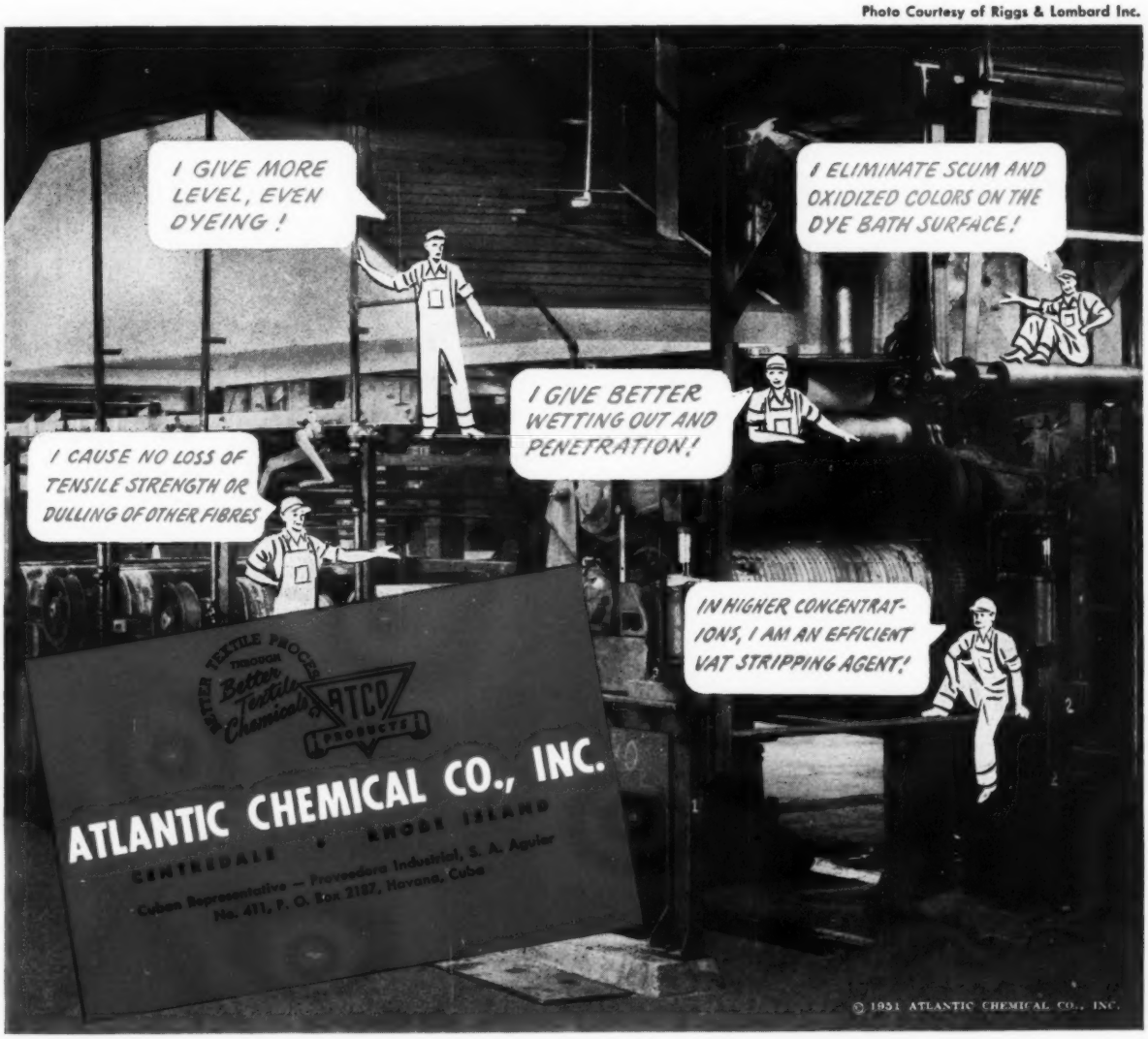
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I GIVE BETTER WETTING OUT AND PENETRATION!
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